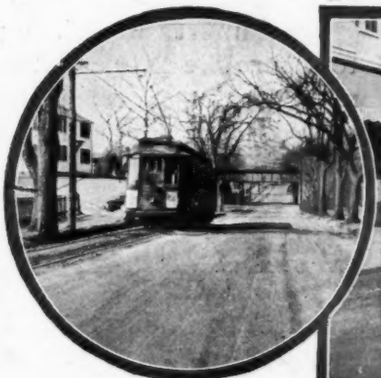
PUBLIC WORKS

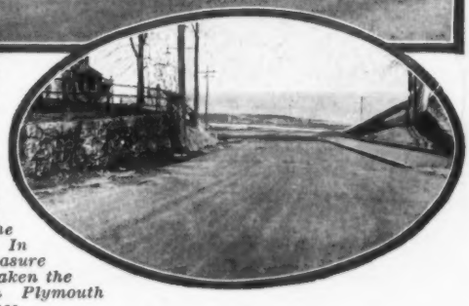
CITY COUNTY STATE

Tarvia Auto-Truck Distributor—the herald of smooth, mudless, dustless, all year traffic-proof roads.



Court Street: The original "Tarvia-X" street built in 1909 and still a credit to the town.

Civic Center: An Example of "Tarvia-X" construction and maintenance, originally built in 1910.



North Street: Familiar to all the pilgrims to Plymouth as a Tarvia street for the last 13 years. In addition to pleasure traffic it has taken the teaming from Plymouth wharves.

Tarvia in Plymouth, Mass.

THIRTEEN years is a short period in the history of Old Plymouth. But it is a long time for inexpensive pavement to withstand modern traffic, with next to no maintenance.

Mr. Arthur E. Blackmer, Superintendent of Public Works, writes:

"Our experience with Tarvia covers a period of consistent use for thirteen years—the town now has thirteen miles of Tarvia macadam.

"At the recent tercentenary celebration, held in the summer of 1921, over a million strangers visited this historic town, and Tarvia again proved its worth by satisfactorily protecting the roads even though subjected to the consequent unusual traffic."

Plymouth has found through long experience that Tarvia construction insures maximum mileage of well-paved streets—that its moderate first cost permits a more extensive paving program, and its economical maintenance materially reduces the annual upkeep expense.

Not only in Plymouth, but in countless other cities and towns throughout the country, Tarvia is saving money for the taxpayers and providing better streets for all kinds of traffic.

Illustrated booklets descriptive of the various Tarvia treatments sent free upon request to nearest office.

Tarvia
For Road Construction Repair and Maintenance

New York, Chicago, Philadelphia, Boston, Detroit, New Orleans, Birmingham, Kansas City, Peoria, Atlanta, Duluth, Milwaukee, Youngstown, Toledo, Columbus, Richmond, Baltimore, Omaha, Jacksonville, Houston, St. Louis, Cleveland, Cincinnati, Pittsburgh, Minneapolis, Dallas, Syracuse, Salt Lake City, Bangor, Washington, Johnstown, Lebanon, Latrobe, Bethlehem, Elizabeth, Buffalo, Denver, San Francisco

The Barrett Company

THE BARRETT COMPANY, Limited: Montreal, Toronto, Winnipeg, Vancouver, St. John, N. B., Halifax, N. S.

A Clean City for 1923

A Good New Year's Resolution For Every City Official

Clean streets are without doubt one of the greatest single attractions your city can offer, both to its own inhabitants and to visitors. They are like good clothes in that they don't so much call attention to themselves as create a most favorable general impression. The problem of how to secure the cleanest streets for the least money is, therefore, one that is interesting city officials these days more than ever before.

LET US MAKE IT EASY FOR YOU

The Austin Organization has given street cleaning special study for more than a quarter of a century, and as there are as many Austin Sweepers of all styles in use today as all other makes combined, we feel qualified to speak with authority when we say that

An Austin Motor Pickup Sweeper Will Solve Your Problems

Because it is constructed along the lines accepted as standard by all leading manufacturers of motor driven equipment.

Because it is easy to operate, does perfect work, and is by far the most economical method yet devised for cleaning paved streets.

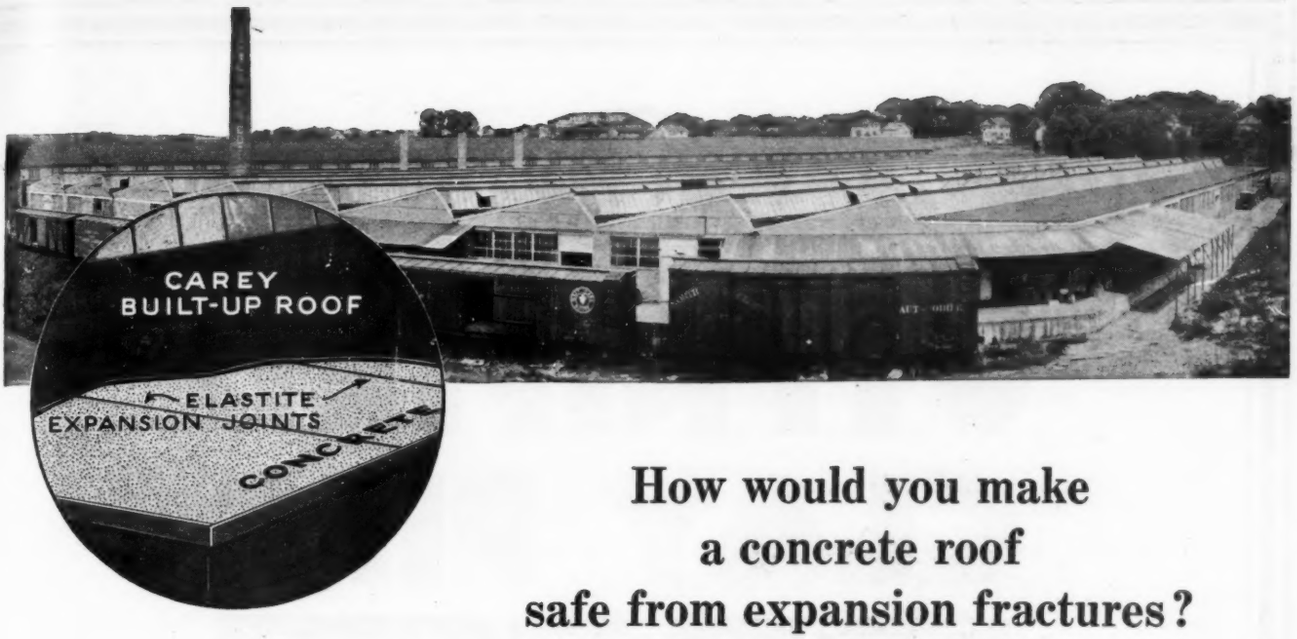
Right now is not a bit too soon to decide what you are going to do about this problem. If you feel handicapped by your present equipment, write and ask us to send one of our sweeper experts to help you select the right equipment to make your city a clean city for 1923.

The Austin-Western Road Machinery Co.

CHICAGO, ILLINOIS

Branch Warehouses and Service Stations

Albany	Columbus	Kansas City	New Orleans	Portland, Ore.	St. Paul
Atlanta	Dallas	Little Rock	New York City	Richmond	Topeka
Billings	Denver	Los Angeles	Oklahoma City	Salt Lake City	Wahoo, Neb.
	Jackson, Miss.	Nashville	Philadelphia	San Francisco	



How would you make a concrete roof safe from expansion fractures?

IN the case of this roof of the Hall Mfg. Co., Cedar Rapids, Iowa, Elastite Expansion Joint was used. The concrete deck is laid in slabs with Elastite at every joint.

In midsummer the temperature on this roof is as high as 110 degrees. In winter it drops to 10 degrees below. But the Elastite never melts in the heat nor loses its elasticity in low temperature. The melting point of Elastite is 250 degrees Fahrenheit. It is still elastic at 32 degrees Fahrenheit.

Elastite makes concrete construction for roofs, streets, bridges and other structures safe from injuries by expansion and contraction.

Elastite shows its superiority over all other joint materials both in service and ease of installation. It is as easy to handle as a board, does not buckle in hot weather and does not break and chip in cold weather.

Immediate shipments anywhere in any quantity from large stocks at seventeen convenient distributing points. Write for sample and further facts.

THE PHILIP CAREY COMPANY
10 Wayne Avenue, Lockland, Cincinnati, Ohio

Elastite is a body of specially tempered asphalt sandwiched between two layers of asphalt saturated felt and comes to the job cut to any dimension and shape, or cut to crown, ready to install in a single operation.

The asphalt in Elastite is refined by special Carey processes producing a material retaining its ductility and plasticity within a temperature range of 32 degrees and 250 degrees Fahrenheit under laboratory tests. This is the reason for the unique service characteristics of Elastite.

10-22

Carey Elastite

TRADE MARK REG. U.S. Pat. Office

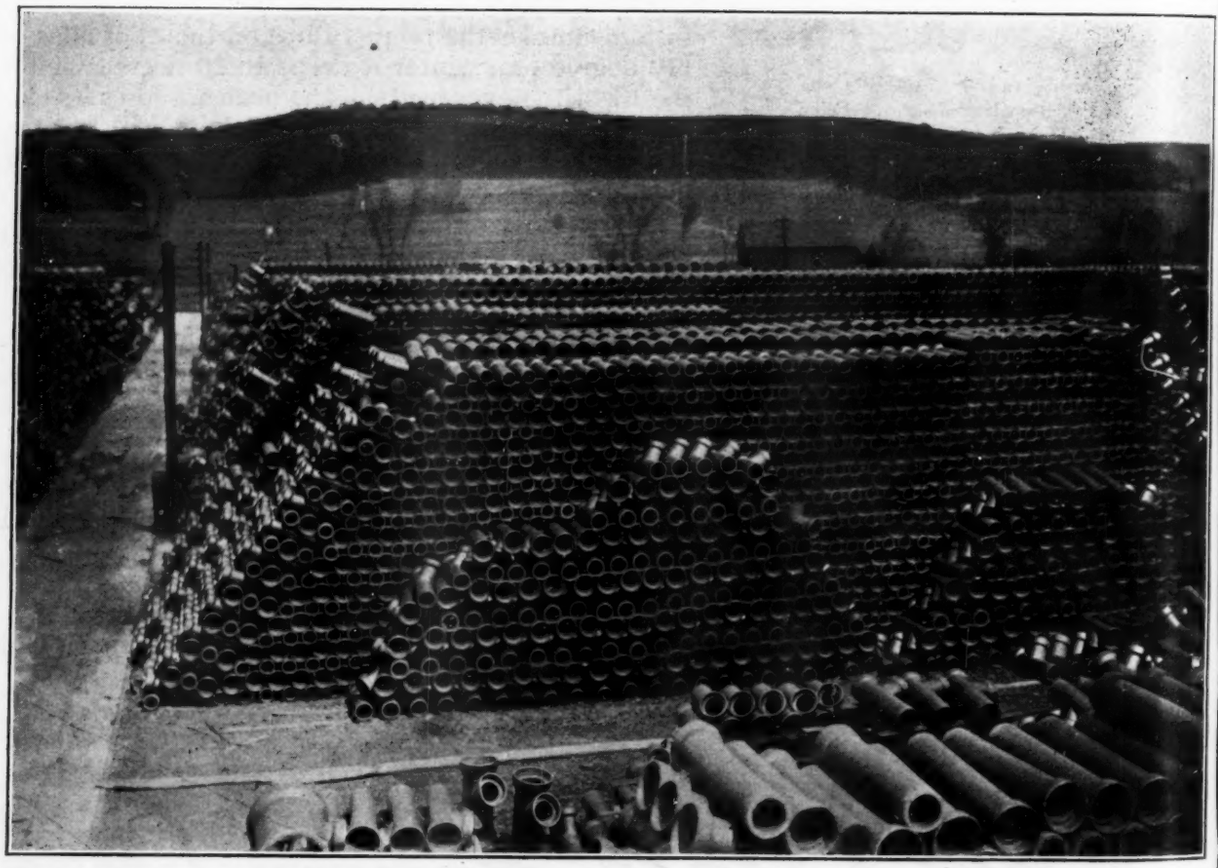
PROVED AND ACCEPTED EXPANSION JOINT

Made like a sandwich
Installed like a board

TESTED BY FIRE

VITRIFIED CLAY PIPE

The Pipe Everlasting



Large stocks ready for shipment at a moment's notice

Thousands upon Thousands
of feet of Vitrified Clay Sewer Pipe
shipped by our various members every day

The importance of quick service and shipping facilities is solved by the location of the companies listed below. Each and every one of the members of this association pursue the most progressive known methods. Shipments made right to the job in any section of the country, promptly and efficiently. SERVICE FIRST—LAST—AND ALWAYS. And **Remember**—The association's facilities are at your service without charge.

Our engineers are ready at all times to give you complete information regarding the manufacture and use of Vitrified Clay products for every use.

We have ready for distribution a number of publications which will be of interest to you, including a handbook on house sewers and house drains. Write for copies and tell us your problems.

For Full Particulars write

Eastern Clay Products Association

Henry T. Shelley, Secy.-Mgr. :-: **Phone Spruce 5029**

906 Colonial Trust Building, Philadelphia, Pa.

Members Eastern Clay Products Association

The Buckeye Fire Clay Co., Uhrichsville, Ohio

Cambria Clay Products Co., Blackfork, Ohio

Clearfield Sewer Pipe Co., Clearfield, Penna.

Crouse Clay Products Co., Akron, Ohio

The Dennison Sewer Pipe Co., Dennison, Ohio

East Ohio Sewer Pipe Co., Irondale, Ohio

Evans Pipe Co., Uhrichsville, Ohio

Junction City Sewer Pipe Co., Junction City, Ohio

Logan Clay Products Co., Logan, Ohio

Patton Clay Mfg. Co., Patton, Penna.

Pennsylvania Clay Products Co., West Winfield, Penna.

Portland Stone Ware Co., 49 Federal Street, Boston, Mass.

Robinson & Sons Sewer Pipe Co., Uhrichsville, Ohio

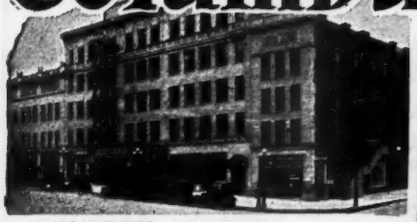
Robinson Clay Product Co., Akron, Ohio

Ross Clay Products Co., Uhrichsville, Ohio

St. Mary's Sewer Pipe Co., St. Mary's, Penna.

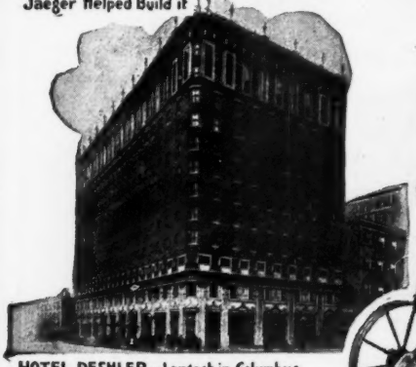
Wolf-Lanning Clay Co., Dennison, Ohio

Columbus-99% for Jaeger

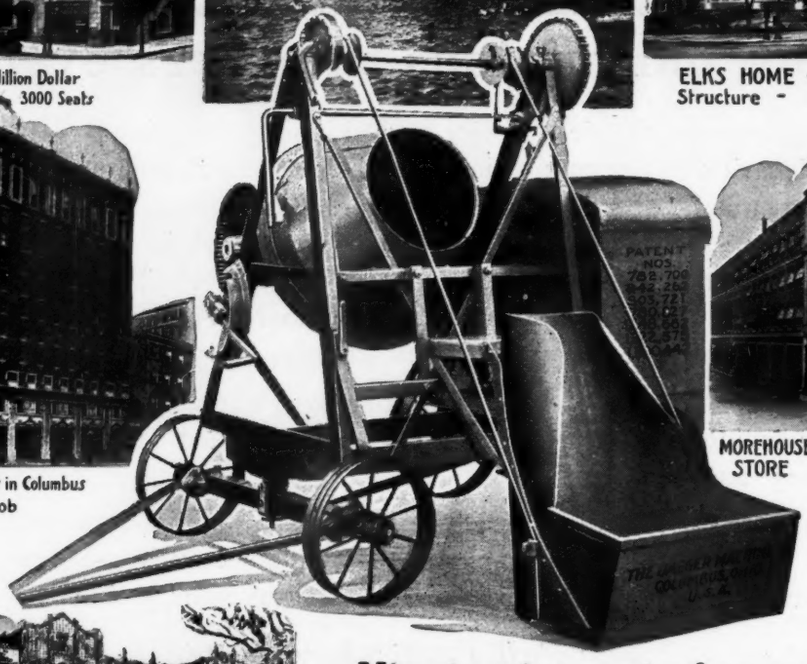


JAMES THEATRE - New Million Dollar Motion Picture House 3000 Seats
Jaeger Helped Build it

ELKS HOME - Half a Million Dollar Structure - A Jaeger Job



HOTEL DESHLER - Largest in Columbus
400 Rooms - A Jaeger Job



MOREHOUSE-MARTENS - New $400,000 STORE - Jaeger Poured.

Y. M. C. A. - New Million Dollar Structure - Jaeger Poured

LAZARUS STORE - Columbus' Largest Store - 150,000 sq ft
A Jaeger Job

Ninety-nine out of every hundred concrete mixers in Columbus, Ohio, are Jaegers

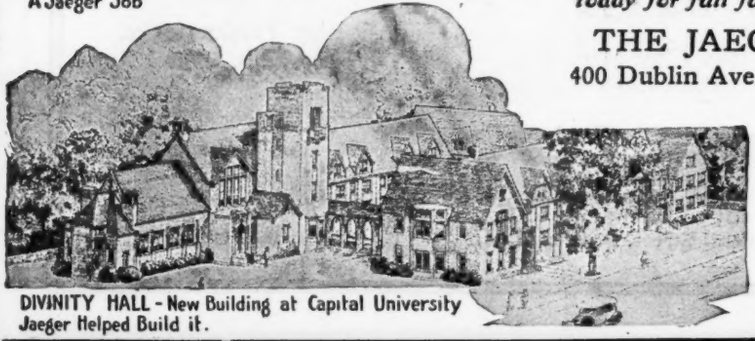
COLUMBUS is, indeed, a city "built by Jaegers." Practically every good-sized building erected here during the past 10 years has seen a Jaeger on the job.

True, this is the home-town of Jaeger Mixers. Yet something more than loyalty to home-town industry prompts Columbus contractors to buy Jaegers—*for they keep on buying them.* There are over 350 in use in Columbus today.

These men like the speed of the Jaeger tilting-drum feature. They like the simplicity, the perfect mixing quality, the low upkeep of this "Mix a Minute" outfit.

But you don't need to come to Columbus to find Jaeger enthusiasts. Ask almost any contractor in your town about the Jaeger. More than likely he will be one of the 18,000 satisfied Jaeger users. There's a Jaeger Mixer especially adapted to every type of public works concrete job. *Use the coupon today for full facts on this line of 18 mixers!*

THE JAEGER MACHINE COMPANY
400 Dublin Ave. Columbus, Ohio



DIVINITY HALL - New Building at Capital University
Jaeger Helped Build it.

The Jaeger Machine Co.
400 Dublin Avenue
Columbus, Ohio.

Gentlemen:—

Please send me full information on the Jaeger line of mixers.

Name .....

Address .....

.....

LOUISIANA
Warren-Bitulithic Pavement on Alexandria-Camp Beauregard Highway, paved in 1918.

Speaking of this road and of

WARRENITE-BITULITHIC PAVEMENT

A member of the Louisiana Highway Commission says:

> "It was not necessary to build detour roads—saved annoyance and worry. This road has given excellent service, requiring little maintenance and has proved satisfactory to Parish, State and Federal Government officials."

And the same story comes from all parts of the country where this pavement is in use.

WARREN BROTHERS COMPANY

EXECUTIVE OFFICES:
BOSTON, MASS.

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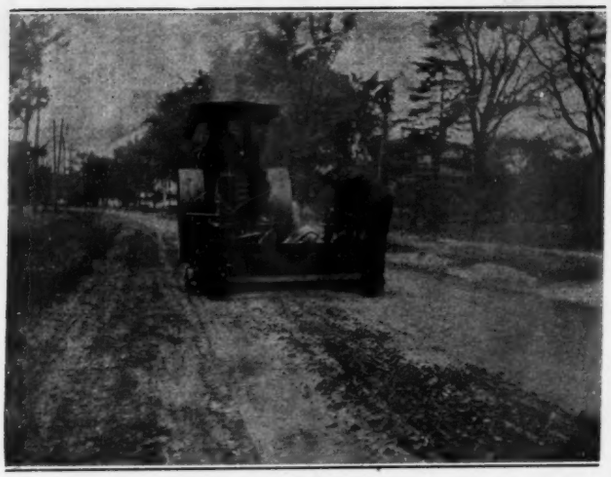
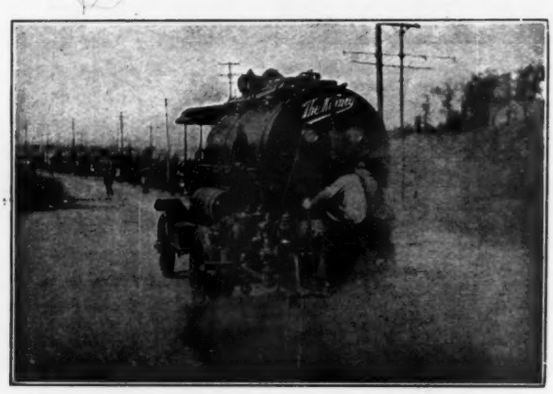
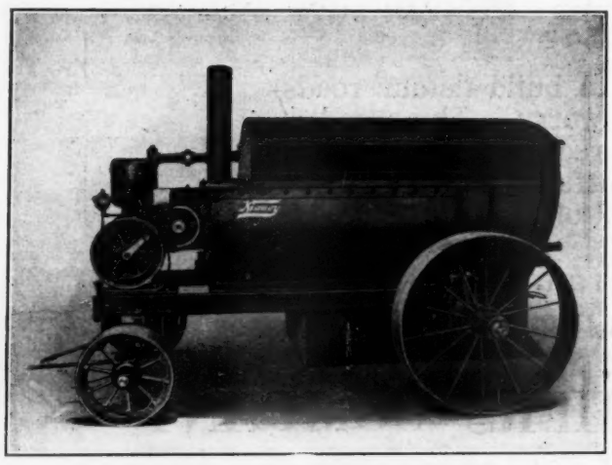
UTICA, N. Y.
WASHINGTON, D. C.
DALLAS, TEX.



ROAD PLANER



PATENT COMBINATION AUTO HEATER AND SPRAYER



HANDY HEATER AND SPRAYER

TRADE MARK Kinney REG. U.S. PAT. OFF.

ROAD EQUIPMENT

Road Planer

This machine removes the bunches or ridgy elevations from the road surface without destroying the general contour of the road. The facilities for adjustment of the scarifiers and planers in any desired angularity or depth of cut, will fully meet the different conditions arising from changing temperatures or varying viscosities of the material used in the construction of the road. While designed especially for use on bituminous surfaces, the planer may also be used to good advantage on macadamized or dirt roads.

Patent Combination Auto Heater and Sprayer

Heats and applies under pressure all varieties of Bituminous materials; hot or cold. Heat and volume under instant control.

The tank and entire equipment can be removed and truck used for other purposes if desired.

Handy Heater and Sprayer

Especially adapted for Road Maintenance, Construction and General Repair Work.

Contents thoroughly agitated while heating. No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated. No steam required.

Kinney Manufacturing Company

BOSTON, MASS.

New York *Philadelphia* *Chicago* *Houston* *Kansas City* *San Francisco*
Philippine Islands *Porto Rico* *Cuba* *Hawaiian Islands*

Stanolind

Paving Asphalt

The Ideal Country Road

VERY few pavements have the hard wearing traffic that falls to the lot of the average country road. Automobiles and trucks, tractors and wagons, loaded and unloaded, all conspire to effect its destruction.

To stand up under these trying conditions the road must be constructed to meet them. A substantial subgrade—a firm base and a shock-absorbing wearing course are the three factors essential to any road where traffic impact is heavy.

14TH NATIONAL
GOOD ROADS SHOW
UNDER THE AUSPICES
A·R·B·A·
COLISEUM, CHICAGO ILL.
JAN. 15-19, 1923
VISIT OUR EXHIBIT

BOOTHS 9 AND 10, SECOND FLOOR, BALLROOM. DON'T FAIL TO SEE OUR INSTRUCTIVE EXHIBIT ON ROAD MAKING.

Stanolind Paving Asphalt

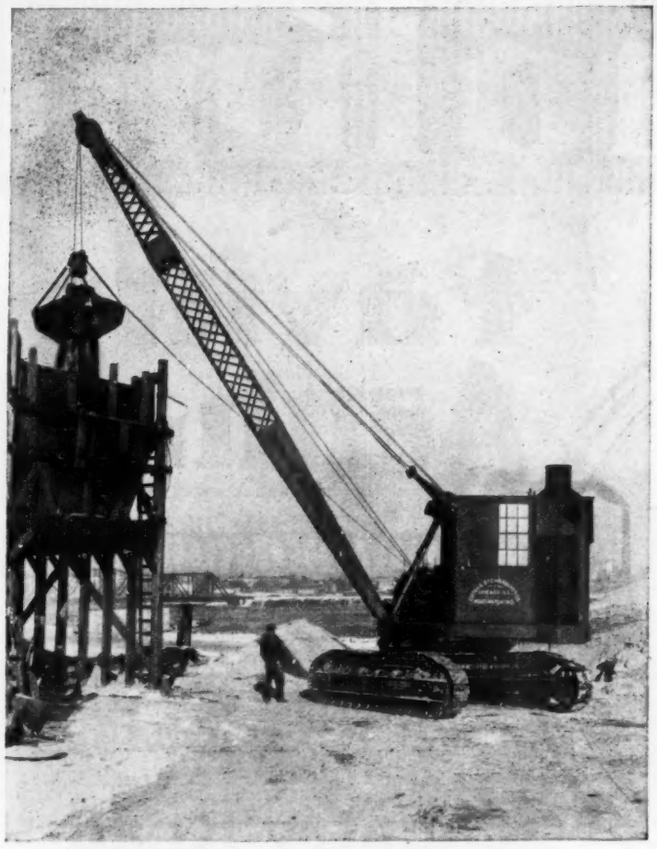
provides an ideal material for the construction of such roads. It is laid at a low initial first cost and requires a minimum of maintenance. This latter feature is important, because money allowed by the tax payers usually does not provide for a large upkeep expense.

Hundreds of miles of country roads constructed by the Stanolind method years ago, are still in the best of condition although very little has been spent on them for repairs. We will gladly cite instances and supply details on request.

STANDARD OIL COMPANY

(INDIANA)

931 S. Michigan Ave. Chicago, Illinois



7-Ton Crawling Tread—40 ft. boom—¾ yd. bucket.

The Answer to Low Cost Material Handling. The solving of loading and unloading problems becomes simple when

O. S.

Dependable Cranes are installed

The Low Cost of Maintenance and Repair have well earned the title of Dependable.

Orton & Steinbrenner Co.
OFFICES:
608 SO. DEARBORN STREET
CHICAGO, ILLINOIS
Shops: Huntington, Indiana

ASPHALT PAVING PLANTS

PORTABLE
SEMI-PORTABLE
STATIONARY

Sand & Stone Dryers
—
Portable Kettles
—
Asphalt Street Tools
—
Brick Testing Rattlers
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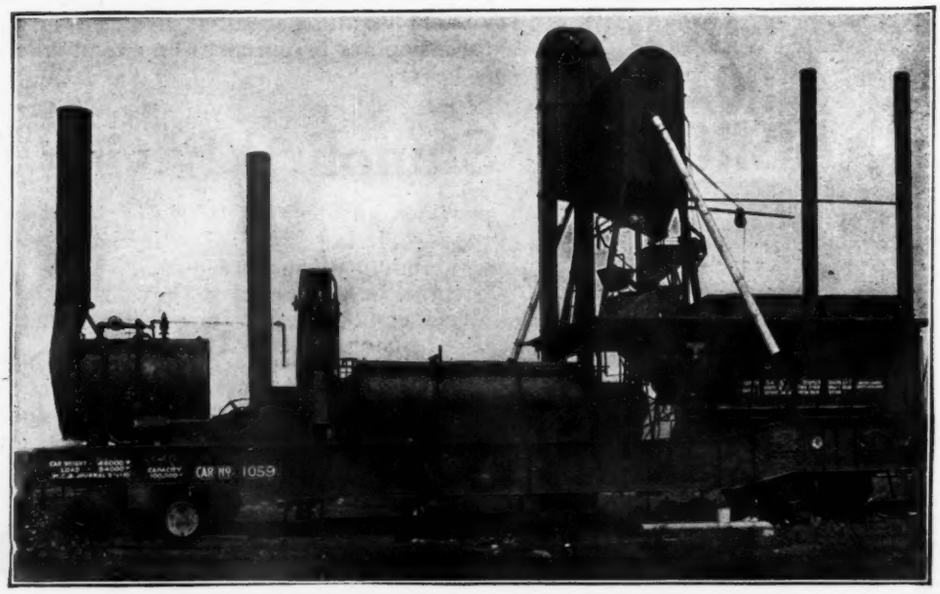
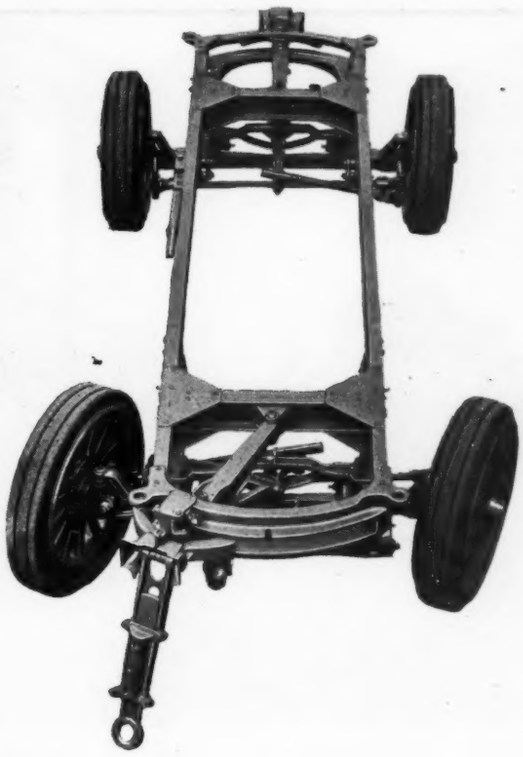
Gravel Pumps etc.



HETHERINGTON & BERNER
INDIANAPOLIS, IND.



DETROIT TRAILERS

Will reduce your transportation costs

Trailers must often by backed through narrow, curving alleys or up to crowded shipping platforms, freight sheds and boat terminals. DETROIT construction makes this easy.

When backing, the end next the truck is locked, automatically disconnecting the extension draw bar from the steering mechanism. This feature obviates the bent and broken draw bars and trailer connections incident to the backing of trailers of ordinary construction, as the driver is free to swing his truck from side to side of the entire limit of the trailer's turning radius. And by means of this "swivel draw head" a DETROIT Trailer can be backed into positions impossible to reach with the truck alone.

Other features include the easily operated and fool-proof locking device; knuckle type axles insuring four point suspension even when both ends are being steered, and the double acting draw bar springs, which by absorbing starting and stopping shocks, add considerably to the life of both truck and trailer.

We believe the DETROIT is the best trailer made. Make us prove it to you.

Made in one of the largest Trailer Plants in the world

DETROIT TRAILER COMPANY 954 E. Milwaukee Ave. Detroit - Michigan

Shonnard Place, Yonkers, N. Y.

This road was built in 1920 using Standard Macadam Asphalt Binder "B" applied by Socony Asphalt Sprayer

STANDARD
ASPHALT
BINDER "B"
For Penetration Work

SO NY SOCONY REG. U.S. PAT. OFF. ASPHALTS AND ROAD OILS STANDARD OIL CO. OF NEW YORK

Standard Asphalt Products

Standard Asphalt Binder A *for surface treatment.*

Standard Asphalt Binder B *for penetration work.*

Standard Asphalt Binder C *for mixing method.*

Standard Refined Mexican Asphalt *for sheet asphalt paving.*

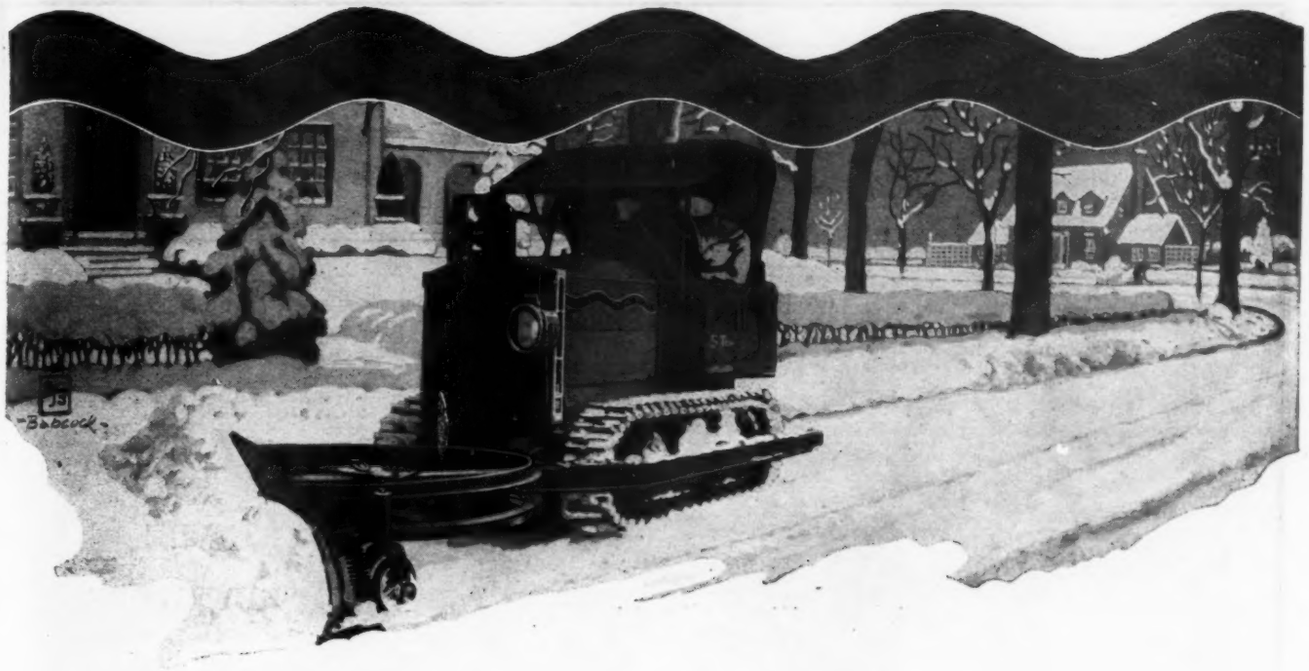
Standard Asphalt Joint Fillers *for brick and block pavements.*

Standard Paving Flux, Standard Bridge Asphalt and Preserving Oils.

Specifications and all other particulars furnished on request

STANDARD OIL CO. OF NEW YORK

26 Broadway



Breaking the Snow Blockade

The "Caterpillar's" field of usefulness is by no means limited to snow removal. There is a "Caterpillar"* of size and capacity for every power need. For grading and maintaining streets and roads, for work on farm or ranch, in the mining, oil and lumber industries—wherever tractive power and endurance are at a premium, the "Caterpillar"* has no real competitor.*

Leaving sixteen states in its wake, the big blizzard of last January struck New York City and New England with staggering force. New York was ready! So were many adjoining "Caterpillar"*-equipped cities and towns. Repeating the performance of the previous winter, New York's fleet of 50 "Caterpillars"* fitted with big snowplows, cut great furrows through the snow-blanketed streets and kept traffic moving. Three "Caterpillars"* put into action on the hilly streets of Yonkers quickly cleared its business and residential districts. Rye, Mamaroneck, and Harrison did equally effective work with their "Caterpillars"* and kept open sections of the Boston Post Road, one of the vital arteries of motor traffic into Manhattan. Every community owning "Caterpillars"* is protected against the traffic tie-ups and the increased fire hazards of snow-blocked thoroughfares. Because of their sure footing and unfailing power, "Caterpillars"* will buck the deepest drifts and clear the snow faster and cheaper than any other method. They can be kept busy the year round grading and maintaining streets and roads. Let us show you our motion pictures of "Caterpillars"* plowing snow-blocked roads.

**There is but one "Caterpillar"—Holt builds it. The name was originated by this Company, and is our exclusive trade-mark registered in the U. S. Patent Office and in practically every country in the world.*

CATERPILLAR
Reg. U.S. Pat. Off.
HOLT
PEORIA, ILL.
STOCKTON, CALIF.

THE HOLT MANUFACTURING COMPANY, *Inc.*

Peoria, Illinois

Branches and service stations all over the world

Eastern Division, 50 Church St., New York

Omaha, Nebraska
Kansas City, Missouri
St. Louis, Missouri
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Holt Company of Texas
Dallas, Texas

Des Moines, Iowa
Minneapolis, Minnesota
Indianapolis, Indiana
Canadian Holt Company, Ltd.
Montreal

EFFICIENT APPLICATION PERFECT DISTRIBUTION
SIMPLIFIED CONTROL

The ETNYRE Distributor in Action

Dependability
of
ETNYRE
DISTRIBUTORS
is your best
insurance.

UNIFORM DISTRIBUTION and thorough penetration are essential to good work and economy in applying liquid bituminous materials.

Both these requirements are fulfilled by the ETNYRE Self-heating Tar and Asphalt Distributor, which discharges through free-flowing spray-nozzles at an even pressure and constant volume.

It is a complete unit, mountable on any type truck, but independent in operation and control.

Full particulars sent without obligation

14TH NATIONAL
GOOD ROADS SHOW
UNDER THE AUSPICES
A·R·B·A·
COLISEUM, CHICAGO ILL.
JAN. 15-19, 1923
VISIT OUR EXHIBIT

E. D. ETNYRE & COMPANY

Manufacturers of a Complete Line of Horse Drawn and Motor Driven FLUSHERS, SPRINKLERS, OIL, TAR and ASPHALT DISTRIBUTORS

OREGON, ILLINOIS

KOEHRING

What are the yardage factors ?

Speed in getting materials into the drum, and uniform mixed concrete on the subgrade.

—*speed,* which because of automatic actions, and simplified control can be *maintained* every minute of the working day.

—*speed which does not penalize by breakdown and delays.*

The Koehring paver is not only the mixer of speed in the chain of operations from charging skip to placement on the subgrade—but, it is the mixer of heavy duty construction that minimizes breakdowns and delays—that delivers at the season's end, the volume of low cost yardage which mean profits. Write for Koehring Paver catalog P 14

Capacities

Pavers: 7, 10, 14, 21, 32 cu. ft. mixed concrete. Write for catalog P 14

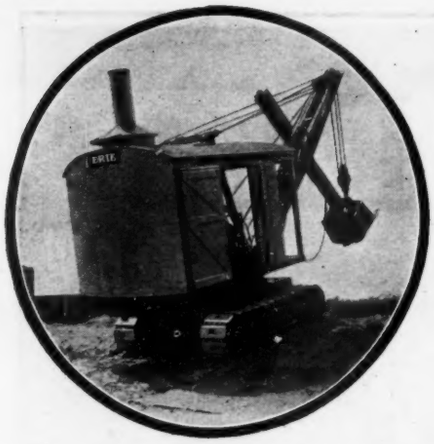
Construction Mixers: 10, 14, 21, 28 cu. ft. mixed concrete. Write for catalog C 14

Dandie: Light 'mixer, 4 and 7 cu. ft. mixed concrete; power charging skip, or low charging platform. Light duty hoist. Write for catalog D 14

KOEHRING COMPANY

MILWAUKEE WISCONSIN

Sales and service offices in all principal cities.
Service Warehouses in all parts of the U. S.



Not "How Much Should It Cost?" but— "How much DOES it cost?"

The buyer of excavating machinery is entitled to know the actual cost of steam shovel upkeep—***not merely five or six unusual records,*** but the averages of many shovels on a wide variety of work.

Upkeep costs are important to the steam shovel owner because of the direct repair expense that is involved—but far more important is the costly loss of time while repairs are being made.

A low repair-cost record spells ***steady operation,*** which is the finest feature of any good piece of construction machinery—the ability to work along week after week, and month after month, without tying up the job.

PRIZES:

FIRST PRIZE, $100.00 and a solid gold watch, 17 jewel Waltham movement, case engraved with winner's name and standing in contest.

SECOND PRIZE, $50.00 and a solid gold watch, 17 jewel Waltham movement, case engraved with winner's name.

THIRD PRIZE, $25.00 and a solid gold watch, 15 jewel Waltham movement, case engraved with winner's name.

FOURTH PRIZE	$20.00
FIFTH PRIZE	$15.00
SIXTH PRIZE	$10.00
SEVENTH PRIZE	$10.00
EIGHTH PRIZE	$10.00
NINTH PRIZE	$10.00
TENTH PRIZE	$10.00
ELEVENTH to 20th PRIZES, inclusive, each	$5.00

In addition to the above awards, $5.00 will be paid for each record that is published.

JUDGES:

The letters will be rated, and the prizes awarded, by the following board of judges:

Arthur S. Bent, of Bent Brothers, Los Angeles, Calif., pioneer contractors on large hydro-electric and irrigation project construction; President of the Associated General Contractors of America.

Halbert P. Gillette, Editor of "Engineering and Contracting" magazine and author of "Handbook of Cost Data," "Earth Work and Its Cost" and many other engineering works.

Arthur C. Vicary, Vice President of the ERIE Steam Shovel Co.; mechanical engineer with many years of specialized experience on steam shovel work.

In making the awards, the judges will consider the actual record made by the shovel, and also interesting and informative details that are given in addition to the actual record. If two machines were to make exactly the same record, the more interesting and informative letter would be given the higher rating; photographs also would be considered.

IN order to provide contractors with this essential information, ***the actual data on upkeep cost and steady service,*** we are offering prizes for the best records made by ¾ cu. yd. shovels which have received good care. We are going to award 20 prizes ranging from a first prize of $100.00 and a good gold watch, down to $5.00, in addition to $5.00 for each record that is published. (See list of prizes, at left.)

In order to avoid comparisons which might reflect unfavorably upon other makes of steam shovels, it has been decided to limit the entries to ERIE Shovels only.

How to enter the Contest

Records may be sent in by steam shovel owners, by managers, or any employee who is in direct contact with the shovel work—the superintendent, engineer, foreman or steam shovel operator. But in every case there must be a written statement by the owner of the machine, to the effect that the figures submitted are correct to the best of his knowledge.

Not more than one letter can be entered from one concern. If two or more entries covering different machines are received from one company, the best letter sent in will be considered. Contest closes December 31, 1922.

Information to be given in letter:

(1) Approximate number of days worked by shovel since put into service.

(2) Approximate number of cubic yards of material handled—stating how much classified as earth, how much rock, how much shale, etc.

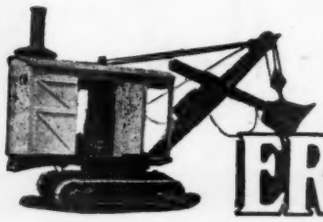
(3) Total amount spent for repair parts. (Do not include dipper teeth, hoisting cable, or grate bars, as these are wearing parts which need replacement on any shovel that is working, even when it receives the best possible care.)

(4) Total lost time, during which the work was delayed for repairs to shovel.

Besides the above information, any additional details of interest should be included, together with one or more photographs of the shovel in action, if available.

Address your letter to A. C. Vicary, ***Vice-President,*** ERIE Steam Shovel Co., Erie, Pa.

If your firm does not own an ERIE and you cannot enter this contest, please refer this advertisement to someone who can act upon it. Thank you!



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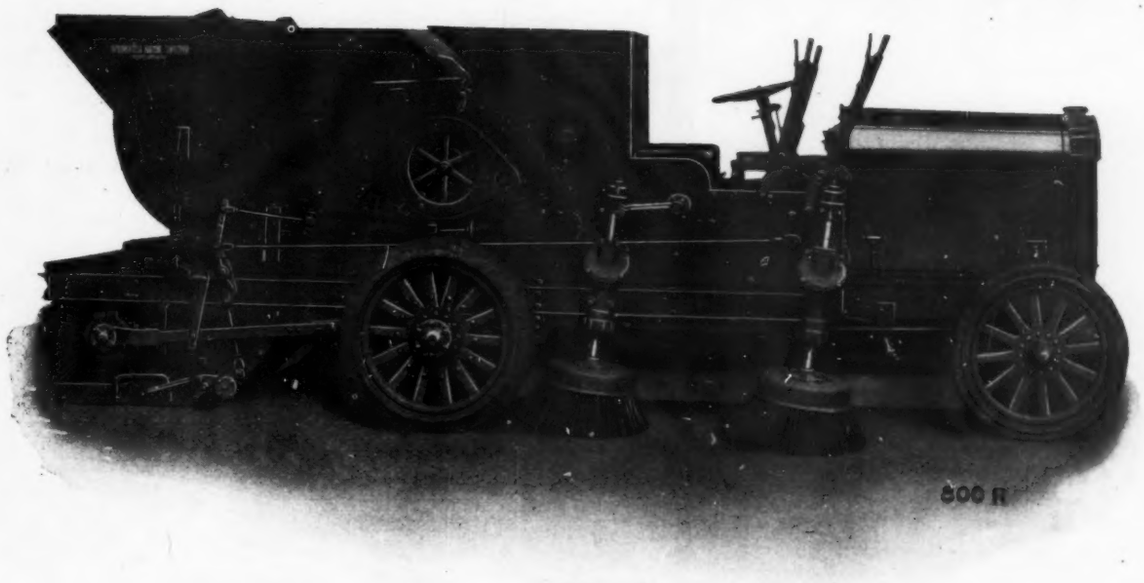

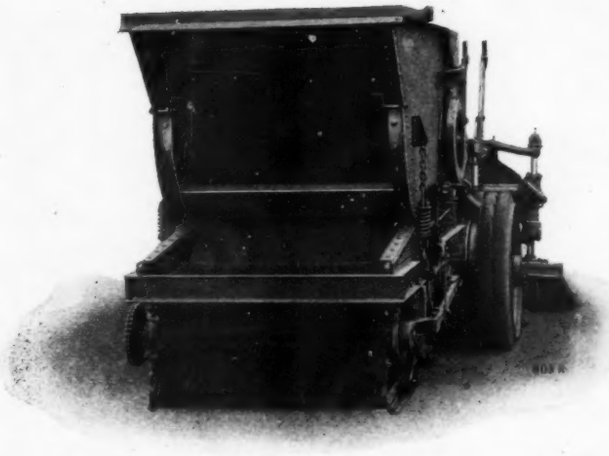

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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 53 December, 1922 No. 10

Garbage Collection and Disposal in Richmond

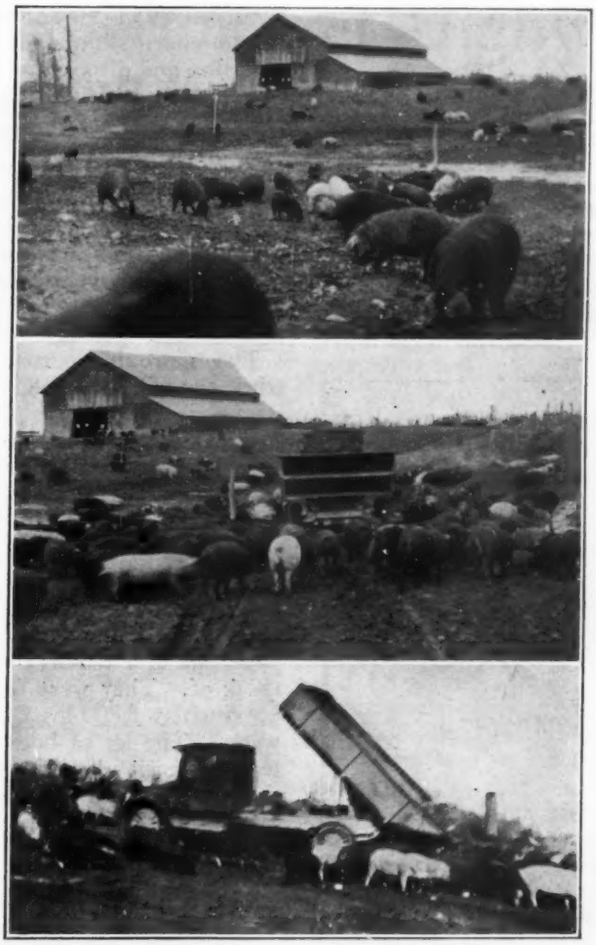
By D. B. Davis*

Garbage collected by city and transferred to hog raising contractor's truck by means of bins at incinerator, where that not suitable for feed is burned. Cost of collection and disposal.

Richmond, Indiana, is divided into four districts for the collection of garbage. Each district comprises an area of about one square mile and is served by a horse-drawn tank wagon of two cubic yard capacity, which collects the garbage twice each week during winter months and twice every ten days during summer. The garbage is collected from cans furnished by the householder. Garbage is emptied into the tank wagons and hauled to the incinerator, which is located in the river bottom, almost in the geographical center of the city. The collectors make two loads each day to the incinerator from each of their respective routes, although they are expected to keep their routes clean and cover them in the time mentioned above.

Prior to 1918 all garbage was burned in the incinerator. In February, 1915, a contract had been made with Henry H. Wagoner, of Huntington, Indiana, to install three separate units of Smith's patent garbage incinerator, each unit to have a daily capacity of six to ten tons of garbage. In 1917 the incinerator had become inadequate and the cost of fuel excessive. Garbage was then hauled to the country in the tank wagons, where it was given to the farmers for hog feed.

In 1919 a contract was let for both the collection and disposal of all garbage in the city. The contract price was $5,338 per year. The contractor collected and fed the garbage to hogs. The arrangement was not satisfactory to the city. Collections were intermittent and complaints numerous. In June, 1922, the city decided to take over the contract. They recognized the inadequacy of the incinerator and did not favor the burning of what they considered good hog-feed. An effort was made to interest large hog raisers with the view of having them take the garbage out of the city. No one, however, was familiar enough with the real value of the garbage as a hog feed to undertake the responsibility of giving bond to the city to remove it regularly. However, a bid was finally submitted by Jesse Druley for disposing of all the garbage collected by the city, the city to pay him $104.16 per month for the service. The city accepted it in preference to rebuilding the incinerator and going back to burning all the garbage.

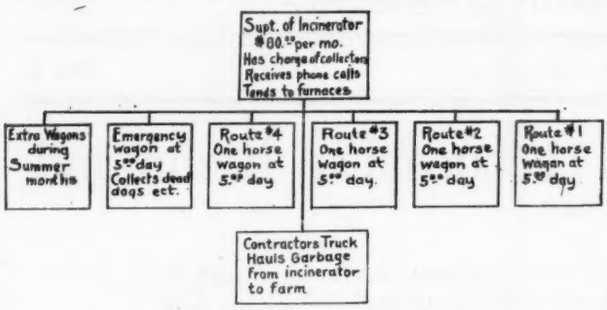


THE RICHMOND HOG FARM.
1—Before the garbage truck arrives. 2—400 hogs follow the truck. 3—Dumping the garbage.

*City Engineer of Richmond, Indiana.

The writer conceived the idea of making the present incinerator an exchange station, where the garbage collectors would bring the garbage to be transferred into the contractor's truck.

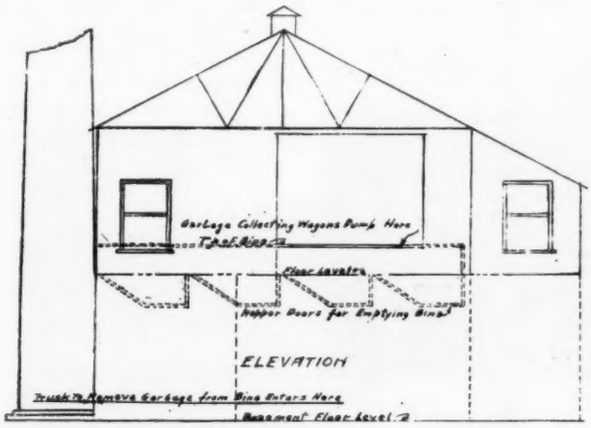
The incinerator is situated on a hill-side, which made it possible to build tanks, for the transfer of garbage, with hopper-dump bottoms, wherein the

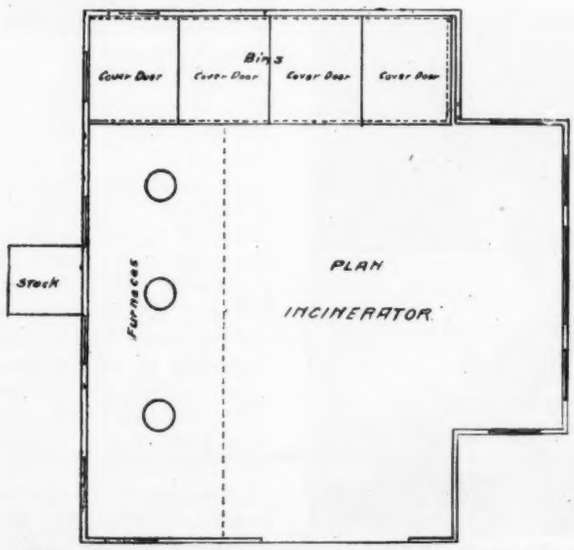

Supt. of Incinerator
$80.00 per mo.
Has charge of collection
Receives phone calls
Sends to furnaces
Extra Wagons during Summer months
Emergency wagon at 5.00 day Collects dead dogs ect.
Route #4 One horse wagon at 5.00 day
Route #3 One horse wagon at 5.00 day.
Route #2 One horse wagon at 5.00 day
Route #1 One horse wagon at 5.00 day
Contractors Truck Hauls Garbage from incinerator to farm

ORGANIZATION CHART.

city collectors could drive in above to empty their wagons and the contractor could drive below to fill his truck by gravity.

Four of these tanks were constructed, each with a capacity of nine cubic yards. Two tanks are all that is used at present, the other two being in reserve.


Garbage Collecting Wagons Pump Here
Floor Level
Hopper Doors for Emptying Bins
ELEVATION
Truck to Remove Garbage from Bins Enters Here
Basement Floor Level



PLAN AND ELEVATION OF INCINERATOR, SHOWING BINS AND HOPPERS.

The underframing of the tanks was constructed from 3-inch I beams bolted together with ⅜-inch machine bolts. Four longitudinal and three lateral supports were used for each bottom section of the tanks. The sloping sides and bottoms are ⅜-inch boiler plate bolted to the underframing. The hopper doors are of a sliding type, giving an opening of 24 inches by 30 inches. The track on which the doors slide was constructed from 3½x6x3½-inch Z bars, with 3-inch channel bars bolted to the inside of one of the projecting angles of the Z bars, the channels being grooved so as to allow the placing of case-hardened steel rollers six inches on center. Bars were bolted to each of the two sides of the door to give a firm, smooth surface coming in contact with the rollers. When the tank is full of garbage, the doors can be slid open easily by hand. Wooden doors were constructed on the top, hinged at the back, with counter weights and cable attached for lifting them. Water drains from the garbage into drip pans which are connected with a sewer. The tanks are flushed each day and no odor is present.

The city does not collect garbage from wholesale fruit stands, groceries, meat shops or fish markets. This garbage is delivered to the incinerator by the respective proprietor's wagons, and, as it is largely unsuitable as hog feed, is dumped into the furnaces and burned at the city's expense. An average of 75 barrels of such material is so disposed of each week. Numerous dead cats and dogs also are burned.

The chart shows the organization of garbage collection and disposal.

The garbage is hauled by the contractor to the country, a distance of 6.8 miles, by a four-ton International truck equipped with an eight cubic yard Wood hoist body.

During July, August and September the truck made four large loads a day to the farm; during October and the first half of November it hauled three loads each day, while at present two loads a day will clean the tanks. The weight of an ordinary truck load of garbage is 5,800 lbs. net.

The approximate cost of operating the garbage truck per trip is as follows:

Driver at $3.00 per day (3 trips)	$1.00
5 gal. gasoline at 22c	1.10
Depreciation on $4,500 cost of truck	.70
Tires	.62
Oil	.03
Total cost per trip	$3.45

In August, Mr. Druley made an experiment to determine to his own satisfaction what hogs would gain on a purely garbage diet. Eighty-nine hogs were put in a ten-acre field containing no grass to speak of. They were fed one load of garbage (approximately 5,800 lbs.) each day with the necessary water. The lot of hogs were weighed prior to the test and each week thereafter for four weeks. At the expiration of 30 days each hog had gained an average of 1½ pounds per day during the test, or the 89 hogs had gained 133½ pounds per day. The price of hogs at that time was 8½ cents per pound. which made $11.35 per day increase from one load of garbage. The best gains known, by feeding hogs on corn and tankage, is two pounds per day.

At present, the garbage is fed in the field, al-

Total Annual Costs of Hauling and Disposal of Garbage

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Hauling	$5,400	$6,300	$6,850	$5,600	$5,700	$5,600	$5,650	$5,450	$4,950	$5,500	$5,500
Coal	490	700	770	500	930	730	450	25	....	....	....
Total disposal	6,700	8,200	8,700	7,200	7,600	7,200	6,850	6,450	5,800	5,500	5,500
Total per capita	.29	.35	.36	.30	.31	.29	.27	.25	.22	.20	.20

though plans are in progress to have concrete feeding platforms built. Four hundred hogs are being fed on the garbage, although this summer, when four loads were secured each day, 735 hogs were fed.

No sickness has occurred among the hogs since feeding the garbage. Attendants stated that the garbage had proved to be a food containing a mixed diet and one containing different elements necessary for gaining weight. It keeps the bowels open more readily than a corn diet and there is less liability for disease.

The pigs are vaccinated when about two months old. The cost of vaccination is approximately 30 to 35 cents per head, depending on the weight of the pig.

EDITORIAL NOTE: It will be noticed in this article that the city not only collects the garbage at its own cost, but pays the contractor for taking it off its hands, although he uses it as feed for pigs. Two years ago pig raisers were quite generally paying cities for their garbage. This change of condition is commented on in the editorial column of this issue. It will also be noted that such garbage as is not used for feed is burned in the incinerator. We understand that the chief reason for discontinuing the burning of all the garbage was that the capacity of the plant was outgrown.

War Department Gives Nevada Draglines

The Nevada State Highway Department has just received from the Government, as surplus war material, three Thew gasoline-driven draglines. These machines, originally costing a large sum, have cost the State only a nominal sum for freight and handling charges and will prove of great value in stockpiling material and other construction activities.

Illinois Experimental Highway Tests

Results of tests discussed. Applicable only to highways with wet subgrades. The new Illinois cross-section. Bituminous base unfortunately not tested.

By CHARLES CARROLL BROWN, M., Am. Soc. C. E.*

Practically all of the sections of the Illinois Experimental Highway have been tested to destruction, only nine sections passing the final test without a break with four others which might have passed except for abnormal conditions, thus raising the number of satisfactory sections to thirteen. Of course, these abnormal conditions might have occurred in any of the sections, probably with similar results. Abnormal conditions also affected some of the sections which failed under the earlier and lighter loads of the test, affecting their relative position in a list of the sections made in the order of their durability as shown by the tests.

The News Bulletins issued by the Illinois Division of Highways after each test with given load give details of the action of the sections of pavement under each load until completely destroyed, so that it is possible to a certain extent to study each section in more or less detail and decide more or less accurately upon the reasons for failure in each case and upon the actual and the relative durability of each section. News Bulletin No. 7, issued under date of November 10, gives in addition a brief statement of the action and final condition of each section in order. It is accompanied by photographs of the sixty-three sections separately or in groups of two to five as they appeared on completion of the tests.

The writer inspected the road while under construction and saw the conditions of subsoil, drainage and pavement construction. This inspection was made late in December, 1920, and covered all the sections in completed form except a few of the concrete sections, the construction of which had been held up until spring by the arrival of freezing weather. Each section was described in some detail in two articles published in the numbers of PUBLIC WORKS for February 5 and 19, 1921.

At that time, it seemed that the location of the test road had been selected because of the bad conditions as to soil and drainage and that pavements which would be successful under the conditions there would be successful anywhere. The soil conditions are duplicated very generally in many parts of Illinois and Iowa, and less generally in other surrounding states where climatic conditions are similar. Drainage conditions approaching those at this location are not uncommon in Illinois. Indeed, they are much too general in that State to be conducive to durability of pavements unless the cost of them is increased. From the point of view of Illinois highway design and construction, therefore, the location undoubtedly has been chosen properly. Likewise the results of the tests are available for the worst conditions in other states. But it by no means follows that it will be necessary for other states to adopt for gen-

* Municipal Consultant, St. Petersburg, Fla.

eral application the plans developed by the Illinois Highway Division from these tests.

Thus far, the publication of results of the tests has been limited to the statements of facts ascertained. Doubtless the results will be analyzed later and the various materials and methods of construction will be compared and contrasted and the kinds and amounts of traffic for which they are individually suitable will be ascertained. Up to this time, the studies, at least so far as they have been published, have been restricted to the concrete sections and the only application of them has been to the design of a standard cross-section for concrete pavements.

In a letter from the heads of the Division to road contractors, the new cross-section is described and the reasons for its adoption are given. They are abstracted as follows:

The cross-section has a thickness of 9 inches at the edges of the pavement. This thickness is reduced uniformly until at 2 feet from each edge it becomes 6 inches and is uniformly 6 inches for the intervening portion of the slab. The bar reinforcement is the same as in last year's standard section, being ¾-inch round deformed-bars placed circumferentially 2 inches from the top of the slab and 6 inches in from the edges of the section with a 3-inch lap at the intersections; also ⅜-inch deformed-bars, 5 feet long and placed 10 feet apart which extend across the longitudinal joint along the center of the pavement. A new design has been made for the reinforcing structure of the longitudinal joint, which supports and joins the two halves of a slab at this longitudinal joint and locks with them and the transverse bars so that no vertical motion of one-half along the other is possible and so that they cannot move apart. This longitudinal reinforcement is adapted to the new 6-inch thickness of the slab in the central portion.

The greater thickness at the edges is deemed necessary because the tests showed that the strength at the edges is much less than at any other part of the slab. A thickness of 6 inches or even 5 inches is shown by the tests to give sufficient strength to carry loads up to the legal limit of weight of Illinois traffic. Nine inches thickness at the edges with the reinforcement makes them equivalent to the 6-inch thickness of the inner portion of the slab. Less than 9 inches is not sufficient. This new form of cross-section will be stronger than the former section with uniform depth of 7 inches, and with 18 feet width of road will require 195½ cu. yd. less concrete per mile. The saving in concrete will soon pay the expense of the tests which make it possible.

The writer visited the experimental highway in October, 1922, after the tests had been completed and while some supplementary tests were under way, and found under construction a section of pavement of the new standard design. It is understood that when this is fully cured, it will be subjected to the same measurements and tests as the other sections, that the efficiency of the design may be tested.

Really, an inspection of the tested pavements is necessary to understand fully the descriptions of results given in the official publications, and an attempt will be made in another article to valuate the various sections for various amounts and weights of traffic. For some sections, this can be done only by comparison of the official reports, but for the pavements having reasonably sufficient bases there was enough wearing surface left to give some basis for forming opinions even from the one inspection. The conclusions drawn will require further discussion and modification if and when those who have had the tests under frequent or constant inspection make more detailed reports. The comparisons of various sections made in News Bulletin No. 7 are scarcely detailed enough to give the impression of being more than the opinion of the assistant engineer who wrote the report and may not be worth any more than the writer's opinion, which is based, of course, on much less detailed inspection.

Of the nine sections considered to have passed the tests successfully and to be still in condition to carry traffic indefinitely, seven seem to be of concrete, one of asphaltic concrete on Portland cement concrete base and one of brick on Portland cement concrete base with bituminous filler. To these should be added three concrete sections and one asphaltic concrete on Portland cement base which had rather unimportant failures caused by defects outside the sections themselves. There were also one concrete section, two of bituminous filled brick on concrete base and two asphaltic concrete on concrete base with corner failures which were not typical and may be neglected.

Thus there are, according to the official report, 11 concrete sections, 4 asphaltic concrete sections, and 3 bituminous filled brick sections which may be considered to be fairly successful.

The regret that no bituminous bases were included in the program is made greater by the action of some of the bituminous and bituminous-filled pavements. The observed action of concrete slabs under temperature changes, described below, which was first discovered in this series of experiments, gives additional reason for testing this well-proven kind of base to ascertain its merits as compared with Portland cement concrete base.

The writer's prediction that, with the clay soil underlying this highway, the base of the pavement would always be wet, especially since there was no adequate drainage of the ditches in any part of the pavement, was more than justified. Water was always found on the subgrade under the pavement bases and slight holes scraped in the earth alongside the pavement would almost always fill with water which would flow off over the surface into the ditch if given opportunity. Since the capillary action of the clay will raise water several feet, it would be impossible to drain the water away by ditches and subsoil drains, and impractical to lift the pavement on a fill high enough to get it above the limit of this action. Gravel and broken stone are too expensive in many parts of Illinois to make it practicable to insert a layer of such material, above the level of the water in the ditches, thick enough to cut off this capillary action, but in other localities this might be more satisfactory than thick concrete, especially if comparative tests demonstrated that bituminous base were fairly near equivalent to Portland cement concrete base and considering also the fact that the bituminous base would lie more quietly on its bed.

The curling of rigid slabs on account of temperature changes, which these experiments show, changes daily from a lifting in the center with an increase in temperature to a lifting of the edges with a decrease

in temperature, is the new discovery. This accounts for longitutidinal cracks and for breaking down of slabs at the edges under heavy loads without taking any consideration of the effects of absorption of moisture, lifting by frost, or settlement by compacting or moving of subgrades softened by the absorption of water. Will the new standard cross-section of concrete pavement overcome the effects of this action? Does this discovery not point to the design and test of a more flexible foundation or of one which will not be so seriously affected by temperature changes? These seem to be the next directions in which investigations should be extended.

Although the lifting of the edges of the rigid slab pavements, which takes place at night or other periods of lower temperature, is slight, it is enough to give opportunity for full bending action of a heavy load on the edge of the pavement slab, and particularly on its corner. If the loads could be kept back from the edge far enough, the deflection of the outer portion of the slab would be slight enough so that the slabs would not be over strained and the truck wheel loads could be applied an indefinite number of times without fatigue of the concrete. This theory is shown to be correct by the results of the tests made after the date of modifying the program of tests by running the loaded trucks west on the north side on a line which kept the centers of the loaded wheels back from the edge of the pavement 2.5 feet, and returning on the south edge of the pavement with the wheels running as nearly as possible on a line 6 inches from the edge of the pavement and even at times, running off the edge of the pavement and back on again, to approximate the effect of turnouts onto shoulders when trucks pass each other on a narrow pavement. The north sides of the pavement slabs carried the loads with much less deterioration of the surface and base than did the south sides. Keeping the traffic off of the outer two feet or so of the pavement would probably have an effect approximating the proposed thickening of the edge. Evidently two feet width of 6-inch concrete would require more material than the proposed thickening, so that, unless traffic is sufficient to demand a wide pavement, say three or four lanes, and trucks can be kept on the inner lane or lanes, the thickening of the edges would cost less than the widening of the pavement. A regulation requiring trucks to keep inside a line drawn 2 to 2.5 feet from the edge might be enforced on a wide pavement, but could not be enforced on an 18-foot pavement, and probably not on a pavement less than 22 to 24 feet wide. Lighter vehicles would not overstrain the concrete if run nearer the edges. The thickening of the edges can be dispensed with, therefore, on the wider pavements under proper traffic regulations.

A report by H. F. Clemmer and C. A. Hogentogler, of the Illinois Division of Highways and the U. S. Bureau of Public Roads, respectively, goes into considerable detail on the distribution of wheel load on pavement sections and the effects of the load in developing strains in the slab, which is worthy of close study.

It is impossible in a single article to go into the details of the action of the various materials used in building the sections of pavement which were tested. They will be taken up in later issues.

Laying Vertical Fibre Brick

By Robert H. McKinley *

Methods of laying that are recommended as the result of experience. Specifications for filler and method of applying it.

"Vertical Fibre" brick pavement with an asphalt filler is by no means a new type of construction, but rather a selection from the many methods which have been used in the construction of brick pavements. Brick 3 inches deep by 4 inches wide by 8½ inches long are laid upon a 1-inch sand cushion over a suitable base of old macadam, rolled stone, gravel or concrete.

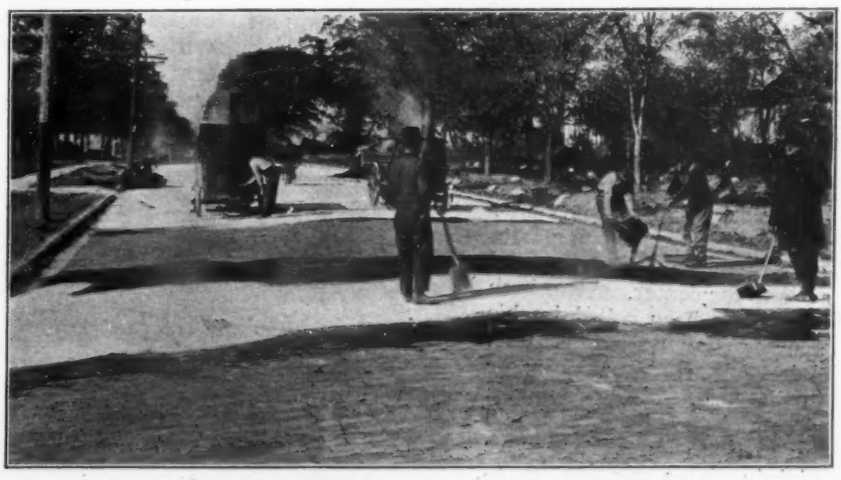
Experience has shown that the advantages of an asphalt filler are many. A flexible filler allows expansion and contraction without damage to the pavement and does away with the internal stresses of the brick wearing surface. It is easy to repair and low in maintenance cost. It is water-proof, quiet, smooth and easily cleaned.

The National Paving Brick Manufacturers' Association has adopted the following Asphalt Filler specifications as standard:

Section 1. Description: Asphalt filler shall be homogeneous, free from water, and shall not foam when heated to 200 deg. C. (392° F.). It shall meet the following requirements:

(1) Flash point—not less than 200° C. (392° F.)

*Chief engineer, Indiana Paving Brick Manufacturers' Association.



APPLYING ASPHALT FILLER TO VERTICAL FIBRE BRICK PAVEMENT IN KENOSHA, WIS.

(2) Melting point (ring and ball)—
not less than 65° C (149° F.)
(3) Penetration at:
0° C. (32° F.), 200 grms., 1 min, not less than 10
25° C. (77° F.), 100 grms., 5 sec., 30 to 50
46° C. (115° F.), 50 grms., 5 sec., not more than 110
(4) Loss on Evaporation—
163° C. (325° F.), 5 hrs., less than 1.0%
(5) Ductility—not less than 3
(6) Total bitumen (soluble in carbon disulphide)—
not less than 99%
(7) Per cent. of total bitumen (soluble in carbon tetrachloride)—not less than 99%
(8) Reduction in penetration, at 25° C. (77° F.), due to heating specified under Loss on Evaporation—
not more than 50%

The above specifications insure a relatively high melting-point, adhesive and cohesive material which is malleable at low temperatures, yet retains its stability at high temperatures. It is a material which is not affected by summer heat sufficient to cause it to run out of the joints in the pavement, nor will it become brittle at low atmospheric temperatures, but will properly adhere to the brick, making the joints waterproof.

In filling the joints of a vertical fibre brick pavement the squeegee method is used, a light carpet coat of asphalt being retained on the surface of the brick which is covered with dry, coarse sand.

A question that arises in the minds of many engineers is that of filling all the joints completely. The brick are lugless, and there is the question of laying them so as to allow sufficient space around each brick to permit the asphalt filler to fill each joint completely from the bottom.

In this connection it is well to consider the brick, the laying and rolling.

It is impossible to manufacture a brick without kiln marks. With the old type of brick this was considered a disadvantage because these kiln marks appeared in the pavement surface, frequently causing a rough-finish surface. The "vertical fibre" brick is laid with the true wire-cut edge in the surface and the kiln marks in the joints, thereby providing a smooth brick surface with ample space in the joints for the asphalt filler.

In handling the brick the setter tries to place them so as to disturb the cushion as little as possible, but there is as a rule a small portion of the sand cushion that is caught between the brick as they are placed.

The brick having been inspected and the culls replaced, they are thoroughly swept and rolled. The roller starts at the curb and rolls forward and backward until it reaches the center of the pavement, then passes over to the opposite curb and rolls to the center. After both sides have been rolled in this manner the rolling is then finished by rolling at an angle to the curb. If the rolling is closely observed the brick will be seen to creep or move slightly. This creeping forces a small amount of sand into the joints, and should a few of the brick be removed it will be seen that in some places as much as a half inch of sand is in the joints, which holds the joints open, and a close inspection will show that there is sufficient space for the asphalt.

The asphalt filler should be heated in a kettle holding at least 250 gallons and whenever possible 500 gallons. The kettles should be equipped with thermometers, so that the temperature of the asphalt can be read easily at all times. The asphalt, which is shipped in drums or barrels, should be broken up into small pieces so as to about half fill the kettle, and a slow fire started in the fire box. When sufficient asphalt has been melted to cover the bottom of the kettle, the kettle can be completely charged, and the fire increased. The asphalt should be stirred at regular intervals throughout the heating to avoid burning, and should be maintained at a temperature of approximately 350 degrees F. during its application.

The brick surface having been swept clean, all joints are completely filled. The asphalt filler is applied to the joints by floating same over the surface of the brick with an iron or rubber squeegee. A wide-mouth pouring pot or a seamless coal bucket makes a very good container for use in applying the filler. The filler should be applied at right angles to the curb, and squeegeed back and forth in the direction of the pavement. Sufficient asphalt filler will remain on the surface of the brick to form a mat with the clean, dry covering material (usually coarse sand) which is then evenly spread over the surface.

The filler should be applied as soon after rolling as possible; and in no case should it be applied to wet brick, but in case of rain, the brick should be covered with tarpaulins in order to keep the joints dry. Each day's run of brick in place should be completely filled the same day.

The brick roadway may be opened to traffic immediately upon completion of the surface dressing.

ASPHALT-FILLED BRICK PAVEMENT, ORANGE COUNTY, FLORIDA

Public Stairways

Many of the cities in this country are located on one or more hills with such steep grades, or with streets so laid out without sufficient consideration of the cross streets connecting them, as to necessitate the introduction of stairways for mounting from one street to another. In these

cases, of course, wheel traffic is entirely excluded. In some instances these stairways have been provided by private funds, as, for instance, by a factory or other employer of large numbers of men, to enable these employees to reach the factory from their homes above or below it.

Probably few cities have a larger number of public stairways than St. Paul. The report of the Commissioner of public works of that city for last year gives a list of 85 stairways built and maintained by the city, the cost having been approximately $31,000.

Of these 85 stairways, 56 are constructed of wood, 19 of cement, 4 of stone, 4 of steel and 2 of reinforced concrete. They vary in number of steps from a minimum of 9 to a maximum of 195. The total difference in elevation between the top and bottom of the stairway averages 33-1/2 feet. Two of these were built in 1887, one of wood and the other of stone, and one of wood in 1892, but all the others have been built since 1900.

The width of the steps varies from a minimum of 3 feet to a maximum of 18 feet, the greater number of them being either 4 or 6 feet. The rise of step varies from a minimum of 4-3/8 inches to a maximum of 9 inches, but only four have the latter height, the great majority being either 6 or 7. The tread varies from a minimum of 8 inches to a maximum of 15, only twelve being more than 12 inches.

These stairs are of all degrees of elaborateness, from a wooden one of 15 steps costing $20 to a stone one of 48 steps costing $4,675. The average construction cost of all the materials was about $11 per foot of rise, or $365 per stairway.

Road Oiling in Wyoming

The November 1st issue of the "Bulletin" of the Wyoming State Highway Department contains an article by the District Engineer of the Second District, R. J. Templeton, entitled "The Experiment with Road Oil," from which we learn that during the past summer the State Highway Department has been experimenting with the use of road oil. Said he: "It will probably be several years before Wyoming is ready to start in hard surfacing roads on a large scale and in the meantime we must make the best we can of our dirt, gravelled and shaled roads, by keeping a smooth wearing surface to the already well built subgrade."

To eastern cities it seems odd to think of considering the use of oil as an experiment, and especially in a state which, Mr. Templeton says, "is rapidly coming to the front as an oil producer."

The department purchased an oil distributor mounted on a Kelly 3-ton truck chassis. The oil was distributed on one section having a gravelled section with poor binder and on another having a shaled surface. About one-half gallon per square yard was applied at 40 pounds per square inch pressure and 200 degrees temperature. After oiling, a coating of fine gravel was spread. The oil, after having been on a month, was found to be binding the surface material and keeping the dust down. On this experiment "will probably depend what part Wyoming oil will play in the surface treatment of Wyoming State roads."

Use of Base Before It Sets

It is generally considered that concrete, whether as base, as filler or as wearing surface, should be allowed to set for seven days or more before traffic is permitted over it. The pavement referred to below, however, apparently suffered no injury, although the blocks were laid on the base when but a few hours old and the pavement thrown open to traffic.

November 13, 1922.

The Editor, Municipal Journal,
New York City.

SIR:

In your issue of August 30, 1919, you called attention to the laying of granite block pavement in Seventh Avenue, Borough of Manhattan, New York City, on concrete foundation, some of which was only twenty-eight hours old.

This was done after careful consideration by the contractor and the writer, who was in charge of the work, in view of the intense traffic to and from the Pennsylvania Station, practically all of which is, however, rubber-tired automobiles.

An examination of the surface of this pavement, now three years old, will, I know, show that our decision has been justified, and will also show a remarkably fine piece of granite pavement for the entire length of the contract—30th Street to 42d Street.

It might be said that, as a basis for the decision, we had experience proving that twenty-four-hour concrete often carries considerable steel-tired traffic without any protection from a wearing surface. This is not to be considered desirable, but occurs in spite of precautions.

Yours,
R. A. MacGREGOR.
Assistant Engineer, Department of Public Works.

Questionnaires for Bidders

The Commissioners Court of Dallas County, Texas, this season adopted a policy of requiring bidders on road work in that county to answer a questionnaire regarding their experience, equipment available and financial condition. The commissioners assert that, while the lowest bid is easily determined, the statute requires that contract shall be awarded to the bidder submitting the "lowest and best bid," and that the latter can be determined only by some such method as this questionnaire.

The questionnaires were distributed to seven bidders on one project involving about $600,000, and no objection was raised at the time and the questionnaires were answered, but some of the contractors have since been complaining against what they call "this unwarranted method."

The contractor is required to give his experience in constructing roads, the equipment which he possesses available for this contract, whether he intends to sublet part of the work, and his financial ability to carry through the contract. The equipment questionnaire is the simplest, merely calling for a list of all articles of road machinery available for use on the project in question, listing these by name, type, size or capacity, and present value. The financial questionnaire requires the bidder to list his assets as cash in bank with name and location of bank, amount of other cash available, cash value of equipment, cash value of stocks and bonds, of notes receivable,

of accounts receivable, and of all personal and real property. Under liabilities are to be listed all outstanding unsecured notes, outstanding mortgage or lien notes and outstanding accounts.

Some of the questions are: "What banks or bankers do you give as reference?" "How much credit will these banks or bankers extend you on this contract?" "Do you meet all obligations promptly and discount your bills?" "Have you ever been insolvent or bankrupt?" "Have you ever failed to complete a contract on account of lack of financial ability?" "How many years' experience have you had in highway construction as general contractor or sub-contractor?" "On what types of construction have you been engaged?" "Have you ever done any work for the United States Government?" "For what state highway department have you performed work and to whom do you refer?" "Under what county have you performed work and to whom do you refer?" "For what corporation or individual have you performed work?" "Do you complete all your work on contract time, unforeseen contingencies allowed for?" " What is the largest contract you ever had and where, giving in detail types of construction, etc?" "Have you a going organization now ready to place on this project?" "If not, how soon can you perfect an efficient organization?"

Economical Control of Chemical Dosage in Filter Plants*

Methods whereby selection of chemicals and details of applying them may be altered to reduce their cost without a sacrifice of results.

By R. A. Maddock†

Usually when city officials engage or consider engaging a man who has had special training and experience in water purification, they are prompted to do so by what they believe he will be able to save for them in dollars and cents rather than that which is of infinitely greater importance,—a safe, pure water supply at all times.

It is fortunate for all of us that in a great many plants (especially in the smaller cities), the opportunity really exists to reduce operating expenses. Our more progressive city officials are beginning to realize that the proper operation of a water purification plant not only consists of hydraulics and mechanics, but is a problem of biology, bacteriology and chemistry as well, and are giving more encouragement to laboratory control.

Perhaps one of the greatest opporunities that usually exists to reduce operating expenses is in the control of chemical dosage. The point of application, agitation and hydrogen-ion concentration, all have an important bearing on economical coagulation and sedimentation, over which the operator usually has control. By careful and intelligent handling, the hydrogen-ion concentration can be adjusted to the optimum PH value, which is necessary for complete or nearly complete precipitation of the aluminum from the alum added to the water, which means less chemicals will be required for a given bacterial, turbidity or color removal. This point has not been very definitely esablished as yet, and the reports from various sections would indicate that it varies for different waters.

Very often the chemicals are introduced into the main just before reaching the sedimentation basin, and while this method is satisfactory under most conditions, it will at times be found an advantage to apply the chemicals at some other point or at several points. If the water to be treated contains much heavy sediment, it would be a waste of money to apply the chemicals before the water enters the basin, since a large portion would be carried down with the heavy particles soon after entering the basin. Under conditions of this kind it would often be found advantageous to let the heavy particles settle out in the first part of the basin without the aid of coagulation, and apply the chemicals at or near the center of the basin if capacity will permit.

In many plants it is necessary to use quicklime (calcium oxid) in connection with sulphate of alumina. To get the best results from its use it should be slacked very carefully. Hot water will be found best for this purpose as the temperature during slacking should be as high as possible.

We know that the temperature of all surface waters fluctuates and that temperature has a marked effect upon coagulation, which is another reason that provisions should be made to apply the chemicals at different points. The proper time to install provisions of this kind is when the plant is built. With all kind feelings, I am prompted to say that we have too many designing engineers who are entirely too unfamiliar with the plant operation end of it. On a great many occasions the credit for a plant that is operated with apparently good results has gone to the engineer when it rightfully belonged to the plant operator.

A method is being installed in the new water treatment plant at Newark, Ohio, which was designed by Charles P. Hoover, assisted by A. R. Hol-

*Paper before N. C. Section, A. W. W. A., at Gastonia, N. C., November 14-16.

†Chemist and bacteriologist in charge of water purification, Charlotte, N. C.

brook, which consists of excess treatment with lime, soda ash and alum, combined. This excess treatment will be obtained by overdosing a portion of the supply and subsequently mixing it with a larger and untreated part of the supply. The amount to be treated with excess amount of chemicals will be approximately twenty-five per cent, immediately after which it will be vigorously agitated for about five minutes. This twenty-five per cent portion will then be mixed with the seventy-five per cent untreated portion in a baffled mixing tank, through which the water will have a carrying velocity of 0.4 ft. per second, the detention period being sixty minutes. The entire body of water will then be passed to concentrating tanks equipped with Dorr thickeners, where the water will remain for about twenty-two minutes. It is pointed out by Mr. Hoover that the extraction of as much as possible of the precipitate or sludge in the thickeners before the water passes to the sedimentation basin will lessen the accumulation of sludge at the entrance of the basin and thus make the basin utilizable to its full capacity at all times. It is believed that this method will prove to be economical as well as efficient.

While the carbonation of water as an aid of coagulation is more or less in the experimental state, it has been reported on very favorably.

John R. Baylis, principal sanitary chemist, Water Department, Baltimore, Md., has recently reported that at Baltimore the addition of a small amount of sulphuric acid to the water before, or at the same time as the alum, has aided coagulation very materially. He reports that several trials have been made under operating conditions with results that show considerable saving in alum. From this experimental work Mr. Baylis draws the conclusion that in most places an acid alum could be used with better results than basic alum, which is being used almost universally.

The waters in some lakes and a few rivers, especially at certain seasons of the year, are comparatively free from coloring and suspended matter and could be treated very successfully, the writer believes, with a method he used at Oshkosh, Wisconsin, for about two years, and which resulted in a large saving of chemicals. Oshkosh gets its water supply from Lake Winnebago, which during several months of the year has very little coloring or suspended matter. The method used during these favorable periods is described as follows: Discontinue the application of chemicals to the sedimentation basin and instead apply a strong solution of sulphate of alumina to the quiescent water in a freshly washed filter bed and allow to stand long enough to break up and form a mat of aluminum hydroxide of a uniform thickness. Some of you will remember a few years ago when asbestos was tried out to produce a filtering mat on the surface of the sand but was a failure due to inability to get a uniform thickness. The amount of sulphate of alumina used depends upon the strength of the solution as well as the area of the sand bed. This solution can be applied through an ordinary garden hose but was applied at Oshkosh through perforated pipes placed over the filters at regular intervals. This method does away with any chance to get alum in the filter effluent and provides a good mat from the very beginning of each filter run. The writer believes this method could be successfully used at a great many plants,—at least periodically.

It has been observed at some few places that chlorination preceding the addition of alum has very greatly aided coagulation in removing both suspended and coloring matter. The application of chlorine prior to filtration is, the writer believes, in many instances good practice, since where bacterial removal alone is sought by the use of alum, to produce an effluent from the filters that will compare favorably to the American Public Health Standard, the substitution of chlorine for alum will be found an effective substitute.

Should a plant operator be classed as careless or incapable because he does not strive to produce a low bacterial count in the effluent from the filters, but who regulates his chemical dosage so as to get a water that is free from suspended matter and depend on chlorination for satisfactory bacterial count? In a great many cases the answer to this question should be "no." Many of those who favor treating the water with sufficient chemicals so as to obtain an effluent that will pass the U. S. Health Standard before chlorination, seem to think that it is unsafe to rely upon chlorine to do its full and just share. This is probably true for the plant that is inefficiently operated and that relies on one chlorinating outfit. All plants should have two complete chlorinating units with a supply of all extra parts on hand so in case one machine goes down and out there need be no delay or interruption in the sterilization of the water. In the larger plants both chlorinators should be allowed to run with the dose divided equally between them.

Proper installation of chlorinators and same operated in multiple units is all that some of our larger cities depend on for the successful purification of their water supply. Of course, chlorinators require intelligent supervision the same as any other mechanical device.

Some few engineers go so far as to contend that chlorine should not be used at all. From the standpoint of economy it seems to me that it is poor business as well as poor judgment to spend four dollars to purify a million gallons of water without the use of chlorine when the same standard of purity can be maintained for two dollars by using chlorine in connection with coagulation and filtration. On the other hand, to insure a constant supply of pure water depending at all times entirely on coagulation and filtration, would in most cases require a trained man on the job every hour of the day and night, which is a condition found only in our largest cities.

In a number of cases chlorination has enabled the rate of filtration to be increased. This increased capacity which otherwise would have called for additional filter units, has been obtained without any further costs.

It is constantly being demonstrated that it is possible to successfully operate water purification plants to obtain the desired clarification and color removal by the use of alum, and rely on chlorination for bacterial removal.

The writer believes that using chlorine on the side of safety is the proper thing to do when treating

such waters as those that show a satisfacory bacterial count when treated to produce one hundred per cent clarification and a satisfactory color removal. However, I believe that in limiting the use of chlorine only as a measure on the side of safety, we are not making proper use of the greatest instrument ever placed in the hands of water purification engineers.

We plant operators are too often inclined to accept the other fellow's word for it that a certain thing will or will not work. The writer believes this in many cases to be decidedly wrong since the conditions under which the other fellow is working may be entirely different from our own.

At Charlotte we have been able to reduce operating expenses about $6,500 per year.

Some one has said that "eternal vigilance is the price of pure water," and in controlling the purity of public water supplies, laboratory control is far more economical and surely more efficient than any other method known.

Oil Pollution of Waters

The pollution of water by oil, while not carrying with it the danger to life that is contributed by sewage pollution, from a point of view of nuisance bids fair to far surpass it. It is found that apparently the oil pollution of waters in harbors and along the coast is due to oil burning and oil carrying steamships, and as the use of these is increasing, the oil nuisance threatens to similarly increase unless something is done to prevent it.

The presence of the oil floating upon the water is not only objectionable to the sight and smell, but it is practically ruining the bathing beaches in the vicinity of all large cities, and is a source of danger from fire. Already several fires have started in oil floating in the various harbors and have threatened and in some cases set fire to the ships. Where oil occurs in any large quantities continuously it drives away fish of all kinds and also shore birds.

Sea Water and Wells

The results of a survey made in 1919 of the ground water obtained by wells on a 30-mile stretch of coast in Connecticut is given in the October number of the "American Journal of Science," supplemented by information concerning wells on the Florida coast and some obtained by foreign investigations.

On the section of the Connecticut coast referred to, which lies east and west of New Haven, shallow wells are affected by salt water for only a short distance from the shore, the maximum distance at which even slight contamination was detected being 250 feet. If, however, natural conditions are disturbed by heavy pumping or otherwise, the sea water may travel inland for a considerable distance.

Even at short distances from the shore contamination was not universal. Of thirteen wells less than twenty-five feet from the high-tide shore line, only four showed more than 300 parts per million of chlorine, two from 100 to 300 parts and three from 25 to 100 parts, the other four wells showing no contamination by sea water. Of seventeen wells lying from 26 to 50 feet beyond the shore line, nine showed no contamination. Of 31 lying between 200 and 500 feet, only one showed any contamination and that merely a trace of chlorine.

Twenty-nine wells from 100 to 300 feet deep were examined, most of them 6-inch wells and nearly all penetrating bed rock. Of these, ten showed positive contamination by sea water and two others probable. It was concluded that the depth of well along this coast should not be greater than its distance from the high-tide shore line.

Conditions on islands do not appear to differ materially from those on the mainland, but in tidal marshes the ground water is brackish and is salty in bars and spits.

As has been shown by many other investigations, it was apparent from these that if the water was drawn through wells and exceeded that flowing toward the ocean from the catchment area behind, water will be drawn from the ocean and contaminate the flow from the wells. Inspection of twenty-three plants pumping from wells and located within 500 feet of the shore along this Connecticut coast showed ten drawing highly contaminated water and four others slightly contaminated.

Apparently the rise and fall of tide had no effect on the contamination of wells from the ocean, but there were periodic fluctuations of salinity at intervals of days and weeks, varying with the amount by which the water in the well was lowered below the ocean level.

Hail Causes a Canal Break

The Reclamation Service of the Department of the Interior publishes an account of a break in a canal with an unusual cause, hail being the primary agent.

A cloudburst occurred in the Little Bitterroot river valley of the Flathead Project on August 30, beginning with hail, followed by rain. This storm crossed the upper half mile of the Camas A canal and swept through a small area of dry farming country, destroying gardens and such grain crops as were not yet harvested, washing out roads and small bridges and culverts on the road to Hubbart reservoir.

The canal is located at the foot of steep mountain slopes, which are heavily timbered with pine, fir, and tamarack. The hail storm which preceded the rain clipped small branches from the trees and the flood from the heavy rain swept the branches and hailstones down the slopes into the canal. Sand and gravel were also carried into the canal from coulees, where the flow of water collected. The canal, which is 150 second-feet capacity, was filled entirely to the top of the bank with hailstones packed in the pine needles and branches A small head of water running in the canal was forced over the bank, causing a small break. On account of the protection afforded the hail from the needles and branches, the process of melting was slow and it was necessary to shovel out a channel after cleaning out the sand and gravel bars with team forces, in order to get water through the canal. Some of the hailstones were more than two inches in diameter.

Cost of Sewer Joints in Wet Trenches

By M. H. WALSER *

Tight sewers obtained by use of special jointing material and jointing form, although water was flowing six inches deep through sewer during construction.

The normal stage of the Mississippi River at Fort Madison, Iowa, prior to the construction of the Keokuk Dam was twelve feet in the spring with an extreme of sixteen feet once in twenty years. This allowed drainage from the entire city and a patchwork of independent sewer systems had been constructed from time to time, which operated more or less satisfactorily excepting during the short periods of extreme high water. By the completion of the dam, located twenty-four miles down the river, Lake Cooper was created and the water level was raised to 16 feet, causing the existing sewer systems to become, in a measure, inoperative.

In 1916 the city employed the Burns & McDonnell Engineering Co. to make surveys and plans for a comprehensive sanitary sewer system, separating the domestic sewage from the storm drainage. The system as designed consists of four distinct portions, three serving the higher parts of the city through gravity outlets above high water and one serving the lower part along the lake through a pumping outlet. Contract for the construction was awarded in June, 1920 to the National Construction Co., of Davenport, Iowa, and work on the pumping system was started one year later with the writer as engineer in charge. Construction was completed in March, 1922.

The pumping system consists of 4.2 miles of eight-inch (8″) to twenty-four-inch (24″) pipe of which 3.4 miles was laid in wet trenches. The low point in this system was at an elevation of 8 feet below the water level in the lake and the floor of the ejector pit in the pumping station was at an elevation 14 feet below the water level. The ejector equipment consists of three 150-gal. P. F. T. ejectors. Air for the operation of the ejectors is supplied with two I. R. single-stage compressors driven by 7½ h. p. motors. The operation is nearly automatic and requires ordinarily only attention for oiling and inspection. The total cost of the low lines was $128,000 and the ejector pumping station with equipment cost $38,000 more.

The lines tributary to the pumping station were all below the level of the lake and in water-bearing gravel and quicksand, and the conditions encountered during construction were such, and the usual water flow was so large, that ordinary mortar joints were out of the question, and experiments were made with various types of joints to select the most suitable. The character of the ground was such that sub-drains were not likely to be of any benefit, and the flow of water was too great to handle in the open trench, so that it was found necessary to allow the water to flow through the pipe to a central point for pumping. The depth of this water was at times half the diameter of the pipe being laid, and the flow in the invert of the tile was never less than three to four inches deep. Conditions were encountered where the sand would boil up from the bottom of the trench and completely cover the pipe being laid. This was accompanied by a subsidence of the surface and quite frequently braces against the sheathing were necessary to hold the pipe to grade and line.

It was early evident that especial care would have to be taken to prevent excessive leakage and it was most desirable to reduce this leakage to a minimum, as all infiltrate as well as sewage had to be pumped up in to the river. A joint developed by the writer for joining the larger sized pipe was first used. This joint consisted of hot asphaltic compound poured into the bell of the pipe together with a concrete cradle to complete the joint. These joints were poured with six to eight inches of water flowing through the pipe and when properly made gave a completely watertight joint. Later the Weston Form and Gasket was tried on this size of pipe and about one-third of the total twenty-four-inch pipe was laid with that joint.

There was very little difference in the cost of laying the two types of joint and the speed of laying, depending largely on the difficulty of getting trench opened up, was about the same. Both types developed about the same amount of faults, and failures due to indifference on the part of the workmen were common to both. For the smaller sizes of pipe a combination of Weston form and gasket and a poured joint of asphaltic compound were used, affording the writer the opportunity to collect some very interesting data as to the comparative cost of laying pipe with these types of joint.

The method of laying was as follows: Two joints of pipe were joined on the surface, using asphaltic compound. These joints were poured ahead of the work of laying and were handled into the trench as one pipe five feet long. One pipe was stood on end with the bell end up and another pipe was centered into it. A small amount of jute was then caulked into the bell and hot asphaltic compound was poured until the bell was entirely filled. The pipe was left standing until needed and no difficulty was experienced in handling, as the compound when cold had suffi-

*Of Burns & McDonnell Engineering Co., Kansas City, Mo.

cient strength that the two pipes could be handled as one single pipe without danger of the joint giving way.

For this work 17,585 pounds of compound costing $818.91 at the work was used. Approximately 8 pounds was used in pouring an eighteen inch (18″) joint; 6 pounds for for a fifteen-inch (15″) joint; and three pounds for an eight-inch (8″) joint. The labor of setting up, caulking and pouring was 0.102 man-hour for 18″ pipe and 0.065 man-hour for 15″ pipe per foot of tile laid. Usually two men worked together on this work and also inspected pipe for flaws before setting up.

As only two pipes could be joined on top without too great length for convenient handiing, every other joint had necessarily to be made in the trench. For this work Weston forms and gaskets were used with a 1:1 cement grout.

These forms consist first of a gasket constructed of sheet iron arranged to fit around the spigot end of the tile in such manner that the opening between the bell and spigot is nearly closed. Then there is a form also constructed of sheet iron that goes on outside the bell and around the lower half of the tile into which the grout is poured to make the lower half of the joint. This form is left in place and the top part of the joint, being out of the water ,is made in the usual manner. Pumping was continued for about two hours after laying, when the water was allowed to come up and cover the pipe.

The cost of laying these joints varied greatly with the depth of trench and class of material in the trench bottom, but averaged 0.4 man-hour for 15″ tile and 0.7 man-hour for 18″ tile in sand and gravel bottom, and 0.45 man-hour for 15″ and 0.8 man-hour for 18″ tile in quicksand, per foot of tile laid.

These costs include only the pipe-laying crew consisting of pipe-layer, grader, assistant grader to handle pipe, jointmaker and mortar mixer. The jointer assisted the pipe-layer in handling the pipe in the trench and usually completed the last joint by the time the trench was ready for the laying of the next section. This is in a trench partly dug with a Parsons' excavator and finished with a clam-shell and is in decided contrast to the cost of laying the same tile in a trench dug by hand, which averaged 0.25 man-hour per foot of 15″ tile laid.

Mortar for joints was mixed with equal volumes of cement and sand and was poured rather wet from a specially constructed pouring can. An average of 0.082 cubic foot of mortar was used per foot of 15″ tile at a cost of 3.4 cents per foot, while 1.2 pounds of compound per foot was used at a cost of 3.9 cents; this shows a slight saving in favor of the mortar joint without considering the cost of the Weston forms, which had to be left in the trench and which cost 10.5 cents per foot of tile for both form and gasket. In addition, it is interesting to note how the alternate joint poured on the surface at a cost in labor of 0.065 man-hour per foot compares with the next joint poured in the trench at a cost in labor of 0.4 to 0.45 man-hour per foot of tile laid, an evident saving on each surface poured joint of not less than 0.3 man-hour per foot of tile laid.

That the methods used were reasonably successful is evidenced by the fact that after completion, the infiltration amounted to only 85 gallons per minute for the entire 4.2 miles of deep line, a very reasonable amount considering the exceptionally difficult construction.

Activated Sludge for Packing House Waste at Mason City

A plant installed last year for disposing of packing house waste at Mason City, Iowa, by the activated sludge process has been described by Edward Bartow in a paper before the Iowa Engineering Society, from which the following is abstracted.

In March of 1921 the District Court ordered Jacob E. Decker and Sons, packers, of Mason City, to provide some method of so treating their waste as to improve the condition of Lime Creek within thirty days. An extension of time was of course necessary, but the plant was constructed and put into operation as rapidly as possible. Investigations already made by the Sanitary District of Chicago and the packers at the Union Stock Yards had indicated that the activated sludge process was most desirable for treating packing house waste liquors, which contained blood, grease, hair and other organic matters, and it was believed that the same would hold true at Mason City.

Owing to the short time allowed for investigation, a plant was designed which could be enlarged readily if it should prove inadequate, although a larger plant was provided than would be considered necessary for ordinary municipal sewage. It was recommended that there be constructed an aeration unit 39 feet wide, 48 feet long and 15 feet deep, which would give about eight hours detention with 6,000 gallons flow daily and a 25% sludge return.

The plant contains a house for the sewage pumps and air compressors, the aerating tank and a settling tank. All the waste from the packing house is brought to a sump containing two compartments, from either of which it can be pumped by centrifugal pumps into a grease tank, which is 6 feet wide at the surface, 4 feet deep at the shallow side, and slopes to 8 feet on the outer and deeper side. From the latter side, openings controlled by valves lead to a sump from which the sludge can be forced by compressed air to the byproducts house.

From this grease tank the liquid flows to the aeration chamber, and passes four times the length of this chamber after it has been mixed

with activated sludge. Two No. 6 Hytor air compressors built by the Nash Engineering Company, with variable speed motors, furnish air for the plant, having a capacity of from 650 to 2,200 cubic feet of air per minute, or nearly 4 cubic feet of air per gallon of sewage. The air is blown into the sewage through Filtros plates placed at right angles to the line of flow in rows 6 feet apart so that the plates cover about 20% of the area of the tank. Between the plates, the bottom is elevated so that the settling sludge will fall toward the plates and be carried to the surface by the incoming air. This aerating chamber has a capacity of approximately 155,000 gallons, so that, with a flow of 300,000 gallons with 30% sludge returned, there will be a detention period of 9 hours.

From the aerating tank the mixed sewage and sludge passes to a settling tank, a Dorr thickener 36 feet in diameter being used for this. This tank is built of reinforced concrete 14 feet deep and with the bottom sloping slightly toward the center. At the center the sludge drops by gravity into an air-lift well, from which it is pumped by air-lift to the mixing box at the end of the grease tank. One-quarter of the circumference of this tank is depressed, and the effluent from this tank leaves over the depressions, which were made by placing 2 x 4s every 16 inches in the form into which the concrete was poured. The distribution of the flow is found to be more satisfactory than in cases where the entire circumference is used for the overflow.

This plant was put into operation in October, 1921, and improvement in the effluent was noticeable at once and within ten days a satisfactory sludge had developed so that a clear and fairly stable effluent was obtained.

Some trouble was experienced after a Sunday shut-down owing, it was believed, to the rather large settling capacity. This was remedied by returning the sludge at the same rate during the shut-down as during the period of maximum operation. It is thought probable that the addition of sufficient water to form a current through the settling basin would prevent putrefaction during a shut-down.

It is proposed to pump the sludge to tanks in the by-products house, add sulphuric acid which will cause the suspended matter to rise to the surface, when the clear liquid will be drawn off from the bottom and the sludge concentrated with the tankage.

During last winter the plant did not give good satisfaction, either because of the greater number of hogs killed, or because of the cold weather; but during the latter half of March the plant again began giving good results.

Land Disposal of Liquid Sludge

Wet sludge is being disposed of on land at Blackburn, England. At first sewage irrigation was tried, but as the area of land became insufficient, a sludge-pressing plant was installed in 1897. Dortmund tanks, which were put into service soon after this, produced a sludge which did not work satisfactorily in sludge presses, even when large quantities of lime were added. Beginning with 1909 experiments were made in pumping the humus sludge from these tanks directly on to the land formerly used for broad irrigation, and following these, pressing sludge was finally abandoned and the distribution of the wet sludge directly on the land has been employed.

Distributing trenches following the contours of the land carry the sludge on to the area used. Thirty-six thousand tons of sludge were distributed in this way during the past year at an average rate of 120 tons or 26,880 gallons per acre, or a depth of something over one inch over the entire surface. The cost for labor for cutting the trenches and secondary distributing channels and generally handling the distribution is about ten cents per ton of wet sludge.

Dangerous Gas in Sewage Filters

A correspondent of the English paper, "Municipal Engineering and the Sanitary Record," Arthur J. Martin writes to that paper that during July one of his assistants who was examining the alternating gear of a contact filter was rendered nearly unconscious by carbon dioxide gas. Mr. Martin stated that in his experience of 26 years he had never heard of a previous case of this kind, although the manager of the plant in question had had a similar experience.

Explaining this, Mr. Martin says that a sewage filter in oxidizing carbon produces carbonic acid gas which, being heavier than air, sinks to the bottom of the filter and passes off through the underdrains. Where these have a free outlet the gas will flow off with the effluent as fast as it is produced; but where the drains converge in a central chamber, the outlet from which is submerged or otherwise trapped, the gas may be unable to escape and will accumulate in the lower part of the chamber. He, therefore, suggested that those who have occasion to work in chambers in which this gas is liable to collect should not stoop down in them without testing the air in the bottom of the chamber by means of a light.

Chlorinating Sewage at Selma

The sewage of Selma, North Carolina, is treated by disinfection in a plant designed by William M. Piatt in 1921. The plant is contained in a building 20 feet by 10 feet, inside dimensions. The sewage first passes through two basket screens which catch the gross inorganic solids. From the screens the sewage passes into what is called an attrition chamber, the purpose being to hold the organic solids in this chamber until they have been thoroughly broken up before passing them into the disinfection chamber. This chamber has a hopper-shaped bottom, in the bottom of which is a clean-out opening with a pipe leading to the river and controlled by a valve.

The sewage leaves the attrition chamber through a 6-inch pipe about a foot below normal

water level, which carries it into the disinfection chamber. This chamber is provided with two baffle walls extending from the top of the tank to within 2 feet of the bottom, and between these a third baffle extending from the bottom 7½ feet high to within 2 feet 8" of the normal water level. The chlorine and sewage are both introduced behind one of the end baffles, and the mixture is effected while the sewage flows under this baffle over the middle one and under the other end baffle, then leaving through an 8-inch pipe to the river.

In entering the attrition chamber the sewage is directed down one of the slopes of the hopper bottom with a view to continually agitating any matter that may have settled out of the sewage and produce a comminution or attrition of the solids in the sewer. Floating matters are usually arrested in the attrition chamber by the submergence of the outlet pipe, and such as may pass through this pipe into the disinfection chamber are held there by the baffle wall and do not pass out with the effluent.

In applying the chlorine, no effort is made to adjust this to the amount of sewage, but the dose is set for sterilizing the effluent under conditions of maximum flow, it apparently being thought that the economy in attendance more than offsets any economy in chlorine that might be effected. The plant operates without any regular attendant, but is visited only occasionally to empty the basket screens and inspect the chlorine apparatus to see that it is operating and to renew the chlorine tank. The basket screens are raised to be emptied by a chain block and traveling crane. There are two square basket screens which rest in position in the receiving well, being supported by horizontal flanges fastened around their tops.

Chlorine is applied by a Wallace & Tiernan chlorinator, using dry chlorine feed and a composition sponge diffuser, which obviates the necessity of a water supply at the isolated point where the station was installed, and also prevents danger of interruption of the chlorine feed through freezing of the small water piping.

Mr. Piatt has also built similar plants at Tarboro and at Rocky Mount, N. C.

Germicidal Effect of Acid Mine Drainage*

Investigation of Lackawanna and Susquehanna rivers shows that acid reduces bacterial content more than 99 per cent. and prevents offensive decomposition of sewage reaching the river.

Investigations made by the Pennsylvania Department of Health show that the acid drainage from coal mines exerts considerable germicidal action upon sewage, and that streams heavily impregnated with acid mine drainage can receive, without creation of nuisance, far more untreated sewage than can normal or alkaline streams.

Lying above and in the coal-bearing strata are minerals containing iron and sulphur, the principal one being commonly known as iron pyrites. Ground water leaching through these deposits into mine openings, and hence in contact with air, causes a decomposition of the pyrites and the release of sulphuric acid.

Therefore, the drainage water either pumped or flowing by gravity from coal mines and the rain water leaching from culm banks is generally strongly acid in reaction.

During the recent coal strike the coal washeries were shut down so that very little coal dust (which gives the water a black, viscous appearance) was present in the streams, but the flow of acid mine drainage continued to be discharged. This condition afforded an excellent opportunity to make field investigations, because the presence of sewage solids could be observed in the streams.

*Paper before Pennsylvania Water Works Association by W. L. Stevenson, Assistant Chief Engineer, Pennsylvania Dept. of Health, slightly condensed.

TESTS OF GERMICIDAL EFFECTS

The Engineering Division of the Pennsylvania department of Health, therefore, made field and laboratory investigations during May and June, 1922, along the Lackawanna river and in the north branch of the Susquehanna river for a short distance below the mouth of the Lackawanna. This work was done under the general direction of C. A. Emerson, Jr., chief engineer; F. M. Daniels, chief of the Laboratory Section, and I. M. Glace, district engineer, by W. L. Long, chemist.

In making the laboratory investigations, sewage was added in various proportions to typical samples of acid mine water. The sewage used had a total count of six million bacteria per c. c., and gas formation was obtained from 1/1,000,000 c. c. samples. After only two hours contact with the acid mine water in ratios of one part of mine water and five parts of sewage, the total count was reduced to 32,300 per c. c. and gas formation to 1/1,000 c. c.

Two hours contact with ratio of one to one reduced the total number to 3,600 and gas formation to 1/100 c. c.

Not only was the total number of bacteria greatly reduced, but the flora surviving the disinfecting action were of a different character from those found in the undisinfected sewage. On the plates planted with the mixture of sewage and the higher concentrations of acid mine

water, most of the typical fecal lectose fermenters were absent. Gram positive cocci, spore forming bacilli and saphrophytic yeasts, molds and aerobic spreading forms were the only ones present.

In another test, sewage obtained from a public sewer which received a small quantity of acid mine drainage was added to a typical mine water in various proportions. In this case the total number of bacteria had been reduced by the small amount of acid mine drainage in the sewer to 15,000 per c. c., but gas formation was obtained in 1/10,000 c. c. portion of sewage.

In all ratios of mine drainage to sewage and with periods of contact of both one and three hours, the total numbers of bacteria were reduced and gas formation almost eliminated.

The sewage used in these experiments had a turbidity which remained practically unchanged for several days. Its hydrogen ion concentration was 6.4. The addition of one part of acid mine water to five parts of sewage changed the hydrogen ion content to 5.3 and caused a flocculation and sedimentation of about 50% of the original turbidity. The addition of one part of acid mine drainage to three parts of sewage gave a hydrogen ion content of 4.4 and caused practically complete sedimentation of the suspended matter in one-half hour, producing a supernatant liquor of zero turbidity.

In a third set of experiments, finely ground anthracite coal was added to tap water and continued to remain in suspension. A series of concentrations were made varying from 0.1 gram to 10 grams of coal in 200 c. c. of water. The addition of an equal volume of acid mine water to all these samples caused precipitation of the fine coal within one hour. The presence of the coal had no effect upon the hydrogen ion concentration of the sample.

FIELD INVESTIGATIONS

In order that the laboratory studies might be confirmed by field investigations, a study was made of conditions in the Lackawanna and Susquehanna rivers. The Lackawanna river about fifteen miles from its source enters the coal regions as a reasonably clean and uncontaminated stream. Not far below this it receives two tributaries, both of which are impounded and used for public water supplies, so that during dry weather most of their flow reaches the Lackawanna in the form of sewage or waste water from coal washers.

It has a rather steep hydraulic gradient, this averaging 13.2 feet per mile from Pittston to Scranton, 20 feet per mile for the next fifteen miles, increasing to 45 feet per mile for the next thirteen miles. Consequently, sewage solids and fine coal are maintained in suspension.

The water shed of the Lackawanna contains about 130 collieries and washeries, but no other stream-polluting industries of much moment. The population of the municipalities on the shed is about 320,000. It is estimated that about 37,000,000 gallons of water is used per day for domestic and manufacturing purposes and about 13,000,000 in the coal industries.

The amount of acidity reaching the Lackawanna from mine drainage and leaching from culm banks is not known, but it is estimated that 23,000,000 gallons of drainage was pumped from the mines per nine-hour day in 1913. A knowledge of the acid and iron content of typical mine drainage leads to the estimate that the river above Pittston contains about one part of mine drainage to six and two-thirds parts of stream flow.

Examination of sewer outlets showed that, in practically all cases where these are submerged beneath the water, the sewage cannot be detected by either sight or smell at any time of the year; the only nuisance being where, at time of low stream flow, the sewer discharged above the water line.

On Sept. 10th, 1922, however, when the mines were not in operation, the sewage of Scranton and other towns up-stream was visibly evident in the water of the river. At sewer outlets and where the sewage was discharged on the bank the typical sewage odor was noted, but at no place was there any offensive sewage odor from the stream itself. At this time the flow of the stream was only about 0.4 second-foot of diluting water per 1,000 persons contributing sewage to the stream, which would be considered totally inadequate for preventing nuisance in the case of ordinary diluting water.

The Susquehanna river is a much larger stream than the Lackawanna, draining an agricultural country and shows little evidence of pollution. For some distance after the confluence of these two streams, the black, turbid water of the Lackawanna and the clear water of the Susquehanna follow opposite banks of the river, but gradually they intermingle. Samples of water from the two rivers were examined for dissolved oxygen content, and the germicidal action of the acid mine drainage was clearly shown by the very slight decomposition of the organic matter in the Lackawanna river water during the incubation period. The biochemical oxygen demand of the two rivers was practically the same, although one was comparatively pure and the other heavily polluted with sewage. Samples of the Lackawanna river water that were kept twenty hours in the icebox were nearly sterile, although others taken at the same time and plated promptly showed an average of about 2,500 c. c. after forty-eight hours on agar at 37.5°.

The sewage of Hazelton is discharged into a small stream composed almost wholly of acid mine drainage. Samples of this stream, taken at a point such distance below the sewer outlet that there had been about forty minutes contact of sewage with acid stream water, showed a total of 1,490 bacteria per c. c., and gas formation was obtained with no dilution higher than 0.1; while samples allowed to stand for eighteen hours showed only 260 bacteria and gas in one c. c. As further evidence of the effect of the acid in the river, even in hot weather no nuisance from odors is reported from this sewage-laden stream.

Building Brooklyn Bridge Pier

Nine hundred and thirty-three reinforced concrete piles cast in double tiers, cured, waterproofed and transported without any cracks. Reinforcement bars bent by hand. Economical method of assembling; forms concreted from floating plant. Piles driven with steam hammer, twin hydraulic jets and special follower.

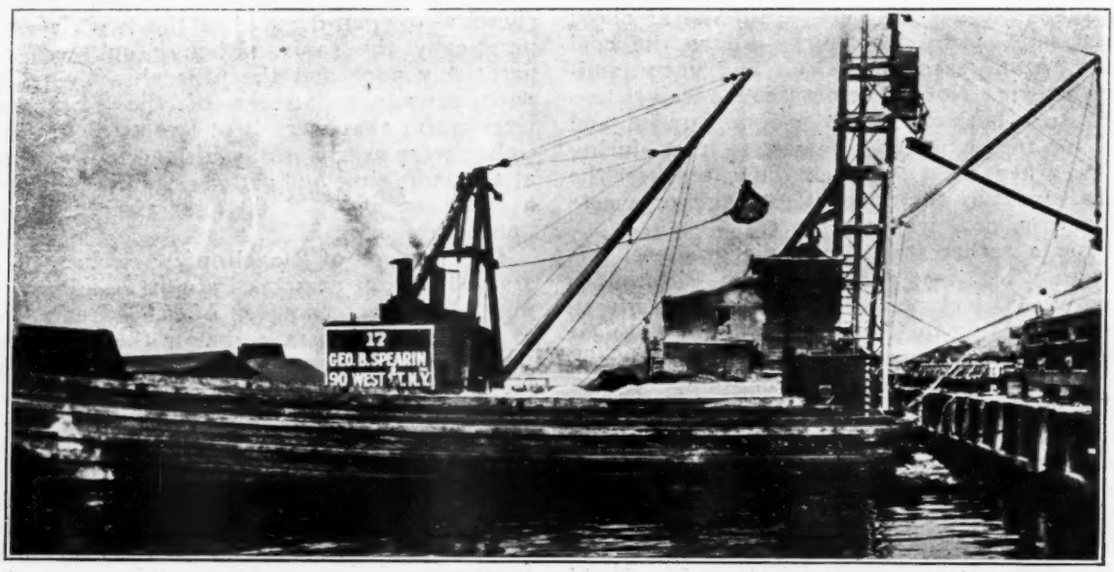
At the foot of Roosevelt street, New York, a pier is being built with reinforced concrete floor or deck, supported on reinforced concrete piles and projecting into the East River, this being the first time that this type of construction has been used in New York. In plan, it is an irregular T-shape with a stem 127 feet wide that is parallel to the shore line and 203 feet long on the river side. The other portions, perpendicular to the shore line, have an aggregate length of 550 feet and width of about 90 feet at the shore end and 40 feet at the river end. The structure contains 933 piles which with the deck were built by the G. B. Spearin Company, New York, for a contract price of about $465,000. The stem of the pier forms a platform entirely enclosing the 130x65-foot pier of the main tower at the west end of the famous Brooklyn Bridge.

The piles, 16 inches square and from 46 to 80 feet long, with pointed lower ends and chamfered corners, are reinforced with four 1¼-inch round bars in each pile and weigh from 6½ to 11½ tons each.

The piles were cast on the contractor's pier at Hunts Point, where space was very limited, and concreting, waterproofing and storing were simultaneously carried on on a platform that was Z-shape in plan with different sections respectively about 300 feet, 280 feet and 460 feet long and all of them about 57 feet wide. Forms for groups of piles of the same lengths were set up on the floor and open transverse spaces 3 feet wide were left between the different groups to provide for the easy disposal of refuse. The middle section of the Z-shape area was reserved for storage and the 460-foot section was used for waterproofing.

The lower tier of forms was made with vertical panels of 2x4-inch planks, built parallel to each other and 18 inches apart on centres, the lower edges of the planks being secured to wooden sills nailed to the floor. Adjacent pairs of planks were braced together by horizontal frames 16 feet long and 16 inches wide over all, which had two side strips and three transverse strips and were supported on cleats nailed to 2x4-inch vertical posts nailed to the form planks 10 feet apart and projecting several inches above them to receive 2x4-inch transverse struts that spaced all of the forms in the set. This arrangement left every alternate opening between the form planks clear to receive the concrete. After the form planks and braces had been removed and the piles painted with petroleum oil, of which about 12 barrels were required, the spaces between the piles were concreted, the vertical sides of the first set of piles serving as forms for the second set. The lower corners of the piles were chamfered by triangular filler blocks placed on the floor; the upper corners were chamfered by a special trowel provided with a triangular rib that was run along the side of the form and made a smooth furrow in the wet concrete.

Pile Reinforcement.—The reinforcement, which



FLOATING, MIXING AND SPOUTING EQUIPMENT FOR CONCRETING PILES.

for the longest piles weighed about 2,000 pounds, was uniform for all piles and consisted of one 1¼-inch bar in each corner of the pile. These bars were received in lengths of 17 to 50 feet, and were over-lapped 5 feet and wrapped with wire at each splice. They were held in position by ¼-inch round wire hoops, 9 inches apart on centres, to which they were securely wired at intersections. When done by the usual method with short pieces of wire, cut to length, one man could make about 250 fastenings in an 8-hour shift. To expedite the work, the superintendent devised a method of reeling the wire from the coils in which it was received to a home-made, hand-operated reel that transferred it to convenient spindles. One end of the wire on the spindle was wound tightly around the intersection of the reinforcement bar and wound, twisted and the wire carried without cutting to the next intersection, wound, twisted and the operation repeated on the next joint, and so on, continuously, thus saving a considerable amount of time and labor and enabling one man to make about 600 connections in one shift, 500 being required for the longest pile.

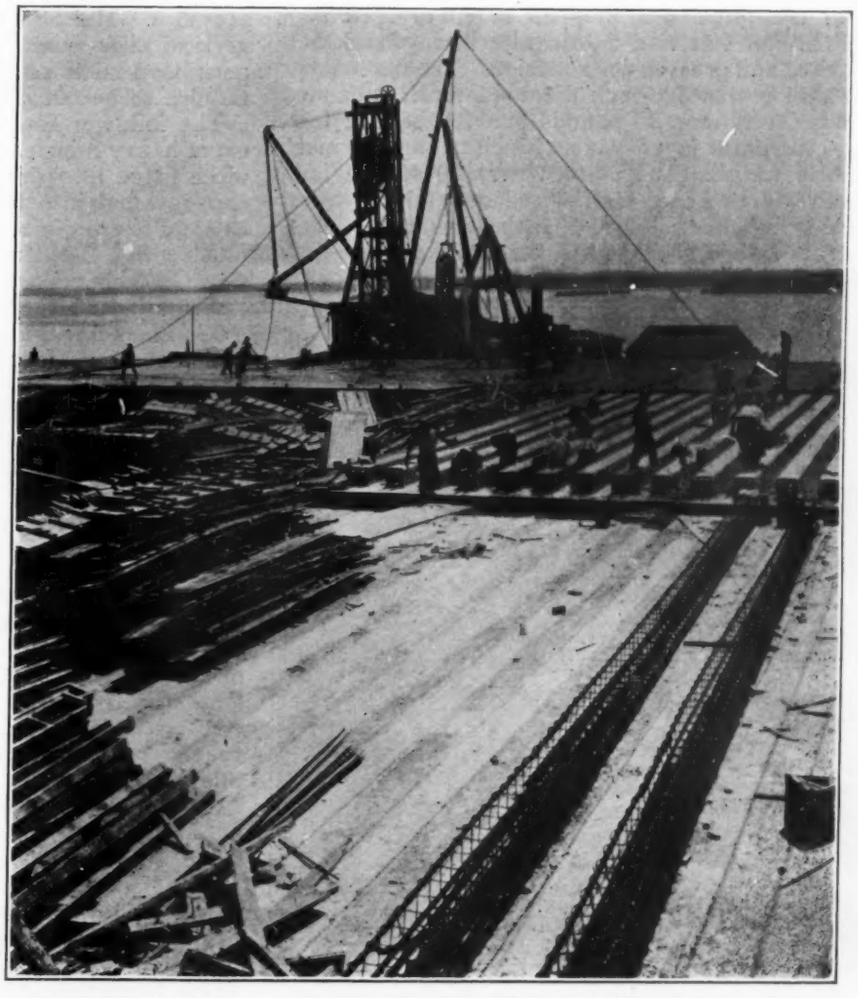
Slab Reinforcement.—The slab reinforcement bars were easily bent by hand with a special tool called a "hickey," which consisted of a short, heavy vertical bar with a long hook pivoted to it and a gas pipe handle several feet in length. The reinforcement bar was placed flat on the deck and the foot of the hickey set on the bending point with the hook engaging it a few inches beyond so that by revolving the extension handle in a vertical plane the bar was easily bent around the foot of the hickey. The men became so expert that two of them working together could make 3,600 single bends on a 1-inch bar in 8 hours, and after some practice did the work accurately, without templates, simply judging the bend by the eye.

A gang of about 40 men were kept busy assembling the reinforcement. The finished units were lifted by hand with carrying hooks and placed in the forms, where they were supported the proper distance above the bottom by Z-shape hooks engaging the upper bars and fastened to 2x4-inch horizontal transverse pieces resting on the upper edge of the form planks. After the concrete was poured, the hooks were detached and used again in the next set of forms.

Pile Concreting—The pile forms were filled with concrete mixed in a 90x34-feet scow, 8 feet deep, moored alongside the casting platform. The scow was equipped with a 1-yard Ransome mixer, a Chain-Belt conveyor delivering cement to the mixing platform, and a 74-foot derrick boom supplying aggregate to the 12-yard elevated stone storage and the 12-yard sand storage bin. The mixer delivered concrete to the hoisting bucket in a tower 50 feet high, that was provided with 70-foot and 40-foot booms carrying the steel chutes for spouting the concrete to position. The concrete plant was operated by 15 men on the scow.

When the first tier of piles were three or four days old, 4x10-inch transverse pieces were set on them and supported 16x54-inch wooden panels forming the bottoms of the forms for a second tier of piles which were made and poured in the manner already described. The first piles were cast July 13th and 554 piles were made in the first lot and 379 piles in the second lot, which was finished March 1. About 4,000 yards of concrete and 670 tons of reinforcement steel were required for these piles.

After the piles had cured sufficiently for safe handling, a single course of them, with 4 inches



CONCRETING SECOND TIER OF PILES. ALTERNATE PILES STRIPPED.

clearance, was laid on four or five lines of transverse 12x12-inch skids about 16 feet apart, the ends of adjacent piles being staggered from 10 to 12 feet to make them conveniently accessible for the application of the waterproofing. Then 12x24-inch skids were laid across the first tier of piles and a second tier of piles similarly placed on them and waterproofed, and so on until all of the piles had been treated and remained in compact storage until removed for driving.

The specifications require that the piles, which were made with 1-1-2 concrete, using ½-inch to 1-inch stone, should be seasoned thirty days before moving and 15 days longer after waterproofing before being driven. They were required to be handled by attachments made at 1/5 of their length from each end, and supported in storage on three or more lines of skids. The upper ends of the piles are required to be waterproofed down to an elevation 2 feet below waterline, thus providing for a length of 9 feet on vertical piles and 11 feet on batter piles with a protection consisting of metal mesh and special mortar.

First there were applied three layers of felt and two of fabric saturated and cemented together with hot coal-tar pitch. The felt was required to weigh 14 pounds per 100 square feet and the pitch was mopped in coats 1/16 inch thick, the felt and fabric alternating and well rubbed and pressed for adhesion. The inner layer of fabric was 3x8-inch diamond mesh expanded metal weighing 27 pounds per 100 square feet, and the outer layer was 4x2-inch triangular mesh fabric weighing 31 pounds per 100 square feet, both layers being well wired on and the outer one being covered with ½ inch of gunite.

Pile Driving—The piles were driven in water from 18 to 35 feet deep at low tide and penetrated through 4 to 10 feet of soft mud to sand and hard clay, encountering considerable obstructions from the ruins of old stone, timbers and rip rap for old piers and bulkheads. They were spotted in the usual manner by alignment with shore ranges and by longitudinal measurements.

FORMS READY TO RECEIVE FIRST SET OF ALTERNATE PILES.

They were driven with a regular pile driver scow having an 86-foot tower and equipped with a 2-drum Lambert hoisting engine and attended by a pump scow delivering 200 pounds working pressure through two 3-inch hose lines each terminating with a 1½-inch nozzle.

The derrick boat delivered piles in sets of about twenty to the pile driver that handled them with a two-part tackle, swinging them to vertical position in front of the leads, where a second line was attached to them and the tackle released. About five minutes was required to pick the pile up and place it in position for driving, where it ordinarily sank about 10 feet into the soft mud under its own weight. An hydraulic jet was churned up and down on each side of the pile, handled by a skeleton engine on the pile driver scow, that settled the pile 10 to 20 feet in from 10 to 20 minutes. The jetting was then stopped and the pile was driven 2 feet farther in from 5 to 15 minutes by a 66,000-pound McKeirnan-Terry hammer operated by steam at 150 pounds pressure. The best day's work was twenty-five vertical piles driven with a special follower that permitted such accuracy that the tops did not require to be cut off.

The follower consisted of a five-foot length of extra heavy 8-inch steel pipe with an oak bearing piece fitted into the lower end and a heavy oak cap doweled into the upper end. Between the cap and bearing piece the interior of the pipe was filled with 1-2-4 concrete reinforced by four vertical ¾-inch rods. A pair of oak fillers were through bolted to opposite sides of the pipe, their outer faces engaging the pile driver leads. The oak foot block cushioned the blows on the concrete piles without reducing the efficiency of impact and the oak cap, 18 inches high, received most of the wear and, like the foot block, was renewed about once a week, while the body of the follower lasted indefinitely. This arrangement was found to be advantageous for the hammer and for the piles and very economical.

Besides the vertical bearing piles, there were also driven 109 batter piles from 58 to 80 feet in length which, during driving, were supported at the required angle by two slings and by bearing on a roller supported by two adjacent piles. These were driven entirely by the use of the two water jets operated on top of the pile and it required ordinarily about one hour to drive each pile.

The work was executed by a maximum force of about 100 men, under the direction of Russell D. Love, superintendent for the contractor, who devised the pile hooks, connection wiring, pile forms, followers and other details of operation. Major Henry Asserson, division engineer, is engineer in charge representing the New York City Dock Department. Joseph De Temple is chief inspector for the Dock Department.

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Profit and Loss in Refuse

Two or three years ago turning garbage into live hogs, or into grease and tankage, was found profitable by a number of cities. Today it is not. What it will be next year we do not venture to predict, but it does not seem probable that those products of garbage utilization will ever again reach war prices.

As to hog raising, we find that a number of contractors who had agreed to pay cities for garbage to be used for feed have "gone broke," while most municipal hog farms have lost money or been abandoned. Even more serious has been the condition of the reduction plants. For a number of months they could find no purchasers of one of their products—tankage—at any price, while the price of garbage grease fell to a fraction of that obtained during the war. Of course, the cost of labor and supplies fell also, but not to the same extent, and the interest and depreciation on the cost of the plant, which was a very large item, remained undiminished. Probably the only plan now practicable for recovering anything from garbage, or even for being able to give it away, is to sell it to farmers who raise pigs incidentally. New England municipalities would appear, from the answers to the questionnaires recently sent out by this journal, to be especially successful in this.

These methods play no part in disposing of rubbish, and for this there would seem to be only two alternatives—dumping on waste land, or burning the combustible matter and using the ashes from this and the incombustible matter for fill. In many cases grading with incombustible matter adds greatly to the value of low, swampy or submerged land, and where there is such a possibility it furnishes the most reliable method of profiting by refuse disposal.

Another possibility of profit is the use of combustible refuse as fuel for power production. As high pork favored pig farming, high and scarce fuel would seem to favor utilization of heat from incineration, with less risk of sudden collape of the revenue-favoring conditions. If not used in this way, the heat from combustible refuse can be utilized for destroying that too moist to burn without dry fuel, such as garbage, dead animals and night soil, and in doing this producing a profit in that it takes the place of purchased fuel that would otherwise be used.

Garbage can be disposed of by burying or dumping, by utilizing, or by burning. Burying requires more land than is available for most communities, and is really expensive if properly carried out. Dumping as generally done creates an indefensible nuisance, and is seldom to be tolerated. The choice between utilization and burning is largely one of expense. Under present conditions probably no community is obtaining a profit from its reduction plant, and the question is whether the loss of operating it is greater than the cost of burning the garbage. Moreover, the cost of a reduction plant is so great that no city of less than 100,000 population could make a profit from it under any condition.

Of the permissible methods of disposal available

incineration with the aid of combustible rubbish would seem to combine the least net cost with the most sanitary and otherwise acceptable results. A careful reading and weighing of the several hundred replies to our questionnaire, which are given in this issue and the January one, would seem to confirm this opinion.

Civil Service Examinations

The following examinations are to be held by the U. S. Civil Service Commission:

Assistant Engineer (Irrigation and Drainage), $1,920 a year. Receipt of applications closes December 26.

Electrical Engineer, $4,000 to $6,000. Receipt of applications closes December 26.

Topographic and Subsurface Draftsman, Grade A, $6.80 per day. Receipt of applications closes December 26.

Computer, Coast and Geodetic Survey, $1,640 to $2,240. Examinations will be held March 7 and 8.

Instruction for Water and Filter Operators

A short course for water and filter plant operators, the fifth, will be held during the week beginning January 15th at Municipal Building, Dallas, Texas, under the auspices of the Dallas City Health Department, with the Texas State Board of Health and the Texas Water Works Association co-operating.

Following general lectures on Monday, Tuesday will be "Filter Plant Day," when the classes will be held at the new White Rock Filter Plant, as will also the classes on Friday, which will be "Filter Plant and Inspection Day." Among the lecturers will be Major J. B. Hawley of Dallas, Lewis I. Birdsall of Chicago, A. F. Allen of the U. S. Public Health Service, R. E. McDonnell of Kansas City and a number of chemists, bacteriologists, engineers and public health experts of Dallas and other Texas cities.

Street Cleaning and Refuse Disposal Data

Information Concerning Appliances and Methods Used by About Two Hundred and Fifty Municipalities, as Reported by Their Officials, in Cleaning Streets, Collecting Refuse of Various Kinds, and Disposing of It.

In the tables given in the following pages will be found information, given directly by the officials of nearly two hundred and fifty municipalities, showing the kinds and numbers of appliances used by each in cleaning the streets and collecting all kinds of refuse; the general plan under which each class of refuse is collected and the cost to the municipality or householders, and the satisfactoriness of the collection. Also data are given concerning the disposal of the refuse, the kind of plant used, if any, the cost and satisfactoriness of operation.

Many of the replies to our questionnaire gave more abundant information than it was practicable to tabulate, and the more important features are given in the following paragraphs, in which will be found some very interesting facts, figures and opinions.

CLASSIFICATION OF REFUSE

Classification of rubbish varies considerably in different sections of the country, which is unfortunate for a comparison of methods similar to that which we are undertaking this month. However, we have endeavored to change the classifications used by the several informants to correspond to those that are used in practically all literature on the subject, namely, garbage, including all food refuse, ashes, and rubbish, which includes all other refuse from residences.

In Havre, Montana, the city ordinance defines garbage as "all refuse, animal and vegetable matter, office, house and store sweepings, ashes, waste paper, and dead dogs, cats and fowls."

Garbage is defined by the city of Seattle to include paper, ashes, vegetable and animal refuse, and all waste material of every kind and description.

In several of the Western states garbage is used to include rubbish, the term "dry garbage" apparently being used for rubbish and "wet garbage" for garbage proper. One case which seems to be exceptional is an Indiana city which uses the word "slops" for describing garbage, while the word "garbage" covers "all except kitchen refuse." It certainly seems desirable that all municipalities should adopt the terminology which is employed by Eastern cities, and, we believe, by all writers on the subject.

REFUSE COLLECTION

OAKLAND, CALIFORNIA

In Oakland, California, refuse is collected by an organization of Italians called the "Alameda County Scavengers' Association," under an arrangement with the city for charging fifty cents per month for one collection per week for an average family of five, this including ashes, tin cans and garbage. The rubbish is dumped.

RICHMOND, CALIFORNIA

Richmond, California, has a contract running for ten years by which the rubbish is collected by scavengers who pay the city for the privilege fifty dollars for the first five years and one hundred dollars per year thereafter. The scavenger is to collect all garbage and rubbish on the basis of stated fees, which the city council may increase if it thinks desirable, and must deposit it

at a point or points designated by council and must burn all inflammable matter, furnishing the oil necessary for this, and keep the dump in a sanitary condition. Collections must be made at least once a week from residences and three times a week from other places. The charges permitted are from 35 cents a month to 50 cents for residences, depending on the haul, with 35 cents per month for each additional collection.

BRIDGEPORT, CONNECTICUT

In Bridgeport, Connecticut, the collection of garbage and ashes and disposal of the latter are performed by the Division of Waste Collection of the Department of Health, there being a superintendent of ash collection, superintendent of garbage collection and superintendent of municipal reduction plant. Ashes are collected weekly by horse-drawn Lee trailers, which are then carried by a Packard truck to a convenient dump. During the year 1921-22 the Division collected 16,255 loads of ashes at a cost of about $2.79 per load. Occasional weighings of loads at different times gave an average weight of approximately three tons.

Garbage is collected in the same way. However, in outlying sections where the houses are widely separated a small, quick-moving motor truck is used, which collects the garbage in large cans and either dumps these cans into the nearest trailer in that part of the city or takes the collection immediately to the reduction plant. This reduction plant is situated directly within the city. During the years 1921-22, 13,807 tons of garbage were collected at a cost of $3.41 per ton and were treated at the reduction plant at a net expenditure of $71,790

HARTFORD, CONNECTICUT

In Hartford, Connecticut, ashes and rubbish are collected mixed by the Street Department, daily in the central part of the city and once a week elsewhere. Receptacles are taken from the rear yard to the curb by employees using light two-wheel hand freight trucks and are returned to the rear when empty. The rubbish is emptied in 4½-cubic yard Watson bottom-dump wagons and is hauled an average distance of one mile to twelve different fills, where low ground is being brought up to grade.

Garbage is also collected by the Street Department, but three-quarters of it is taken by about seventy farmers and used for feeding pigs, each farmer being given a license and assigned a particular route. Farmers having specially good routes are paid nothing, but about fifty are given a small amount of money at the end of each six months, from which fines are deducted for complaints, leaky wagons, lack of covers, etc. Collections are made daily in the business center and two or three times a week throughout the remainder of the city. The garbage collected by the city employees is sold to pig owners, except that a small amount may have to be buried at different times "when there is no market for the entire amount."

From the population of 140,000, occupying an area of 17½ square miles, the city collected ashes and rubbish during the last fiscal year amounting to 286,695 cubic yards at a cost, including repairs and additions to equipment, of 66¾ cents per cubic yard. The garbage collected by the licensed collectors amounted to 18,075 cubic yards, which cost the city 33 1-3 cents per cubic yard. Collections made by the department employees amounted to 5,888 cubic yards and cost $3,394 per cubic yard. Wages of regular employees were $4.50 per 8-hour day, and $9.50 was paid per 2-horse team and driver, the city furnishing the wagons only.

For fifteen or more years prior to June, 1913, ashes, rubbish and garbage were collected under a series of five-year contracts. This method became so unsatisfactory that the work was taken over at the expiration of the last five-year contract on the date mentioned and the municipal collection has been satisfactory to the public.

NO SUPERVISION

An objectionable feature of no municipal supervision over garbage collection is found in a Connecticut borough of 10,500 population. Here farmers collect about 10 per cent of the garbage, but most of the citizens dispose of the garbage in stoves or gardens and the borough engineer reports that "the gardens are filled with garbage and it is impossible to bury same during the winter."

POCATELLO, IDAHO

In Pocatello, Idaho, garbage is collected by two contractors, one from hotels and restaurants without cost to the city, the other from residences, for which he receives $546 a month. The first contractor uses the garbage for feeding, while the second dumps the garbage into a deep ravine approximately a mile from the city limits, where it is burned and covered by an attendant who receives $30 a month. Ashes are collected by the city and when clean are used for fills in streets and alleys, those containing rubbish or garbage being dumped in the ravine.

This gives an average cost during each summer month of $546 to contractor and $30 to dump attendant, a total for the seven summer months of $4,032. During the five winter months there is an additional cost of $130 a month for ash collection, or a total of $3,530 for the five months. For the summer collection of garbage there are used three teams, averaging 2¼ trips per day and carrying 1.3 tons per trip for twenty-five days a month. This gives 220 tons collected and disposed of at an average cost of $2.60 per ton. During the winter the three teams average 1.8 trips per day, carrying 1.3 tons per trip, 175 tons being collected and disposed of at an average cost of $3.30 per ton. One team, averaging 4.5 trips per day and carrying two tons per trip, removes an average of 225 tons per month of clean ashes and cinders from schools and business houses at an average cost of 60 cents per ton. Four hundred tons of general ashes average $1.75 per ton.

EVANSTON, ILLINOIS

In Evanston, Illinois, the householder has the choice of two systems of garbage collection;

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STREET CLEANING

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Alabama:						
Mobile	24	9	none	27 hand brooms, 8 can carriers, 85 street cans, 1 sprinkling wagon (horse), 12 dirt carts	.....	.....
Opelika	..	..	..	4 hand brooms, 1 machine broom (horse), 1 sprinkling wagon, 2 dirt carts	.....	.....
Talladega	..	1½	..	2 hand scrapers, 1 can carrier, 20 street cans, 1 sprinkling wagon (horse)	Asphalt	Hand scraper (cheapest to operate)
Arizona:						
Clifton	7	..	..	2 garbage trucks, 1 sprinkling wagon (motor)	Gravel	Garbage trucks pick up trash
Miami	1	..	..	6 hand brooms, 80 street cans, 1 sprinkling wagon (horse), 2 dirt wagons	.....	.....
Tucson	5	4	none	9 hand brooms, 7 can carriers, 4 sprinkling wagons (horse), 5 dirt wagons, 1 fire hose	Bituminous	Hand sweeping most economical
California:						
Marysville	..	..	..	36 hand brooms, 1 pick-up sweeper, 10 street cans, 3 sprinkling wagons (horse), 3 dirt wagons	.....	.....
Monrovia	3	..	..	12 hand brooms, 2 hand scrapers, 1 machine broom (horse), 1 can carrier	.....	.....
Ontario	..	1	12	12 hand brooms, 1 machine broom (horse), 8 street cans, 1 sprinkling wagon (horse), 1 dirt wagon	.....	.....
Petaluma	1½	..	..	24 hand brooms, 4 hand scapers, 1 machine broom (horse), 2 can carriers, 24 street cans, 1 dump wagon	Macadam Business dist.	Hand brooms White wings
San Bernardino	2	..	5	12 hand brooms, 1 machine broom (horse), 3 can carriers, 6 street cans, 3 sprinkling wagons (horse), 5 dirt wagons, 3 dirt carts	.....	.....
San Francisco	..	..	..	140 hand brooms and scrapers, 10 h.d. machine brooms, 4 motor pickup sweepers, 1,500 street cans, 11 h.d. flushing machines, 1 motor flushing machine, 7 h.d. sprinkling wagons, 12 dirt wagons and steel covers, 50 dirt wagons (rented).	.....	.....
San Gabriel	..	..	20	6 hand brooms, 1 auto truck	.....	.....
Santa Ana	10	1	..	24 hand brooms, 1 h. d. machine broom, 1 motor machine broom, 1 can carrier, 3 h. d. sprinkling wagons, 2 dirt wagons	.....	.....
Santa Barbara	2	56	10	6 hand brooms, 2 machine brooms (motor), 4 pickup sweepers, 2 can carriers, 2 sprinkling wagons (horse), 2 sprinkling wagons (motor), 3 dirt wagons	Macadam and Bituminous Concrete Business dist.	Brooms Flushing White wings
So. Pasadena	2	..	1	12 hand brooms, 4 street cans, 2 sprinkling wagons (horse), 1 dirt wagon	.....	.....
Colorado:						
Denver	70	20	10	150 hand brooms and scrapers, 12 machine brooms (horse), 10 machine brooms and 4 pick-up sweepers pulled by motor trucks, 1 Elgin sweeper, 4 pick-up sweepers (horse), 3 gutter sweeping machines, 500 street cans, 10 flushing machines (horse), 2 flushing machines (motor), 80 sprinkling wagons (horse), 12 sprinkling wagons (motor), 45 dirt wagons, 10 snow blade machines, 24 white wing push carts	Brick and Bituminous Concrete, stone block, wood block Macadam	Flushers Sweepers—Use mostly flushers in summer, sweepers in winter Hand brooms
Fort Collins	10	22	..	12 hand brooms, 18 street cans, 1 flushing machine (motor), 2 sprinkling wagons (horse), 1 dirt cart, 1 snow plow	Concrete Residence dist.	Flusher Sprinkler
Greeley	..	..	..	2 doz. hand brooms, 6 hand scrapers, 2 sprinkling wagons (horse drawn), 2 sprinkling wagons (motor driven), 4 snow plows	.....	.....
Connecticut:						
Hartford	22	none	120	380 hand brooms, 70 hand sweepers, 1 h. d. machine broom, 6 hand pickup sweepers, 312 cans, 4 h. d. flushing machines, 2 motor flushing machines, 25 h. d. sprinkling wagons, 1 motor sprinkling wagon, 2 squeegees, 21 dirt carts, 12 snow plows	.....	.....
Middletown	3	5	16	48 hand brooms, 24 hand scrapers, 2 machine brooms (horse drawn), 3 white wing carriers, 1 flushing machine (horse drawn), 1 sprinkling wagon (motor driven), 2 wagons collect street dirt, 1 cart for same, 2 snow plows	Bituminous Brick Stone, wood block, Macadam Res. dist.	Flusher Flusher Broom Less complaint

New Britain	6	..	30	25 hand scrapers, 1 machine broom (h. d.), 12 white wing carriers, 2 flush machines (h. d.), 4 snow plows	.....	.....	.....
New Haven	80	25	50	20 gro. hand brooms, 100 hand scrapers, 2 machine brooms (horse drawn), 85 white wing can carriers, 1 flushing machine (h. d.) 3 flushing machines (motor driven), 10 sprinkling wagons (horse drawn), 1 sprinkling wagon (motor driven), 10 wagons for collecting street dirt, 4 carts for collecting street dirt, 2 snow plows	Bituminous Concrete Brick, stone, wood, macadam Bus. dist. Res. dist.	Brooms Flusher Brooms Flusher Brooms	Too much water ruins bituminous pavement. Water on wood block is dangerous
New London	3¼	2.3	..	12 hand brooms, 1 h. d. machine broom, 12 can carriers, 24 cans, 1 h. d. sprinkling wagon, 2 snow plows	.....	.....	.....
Willimantic	..	..	..	2 white wing carriers, 1 sprinkling wagon, 3 trucks collect street dirt, 8 snow plows	Stone block, macadam Bus. dist.		White wings
Dist. of Col.:							
Washington	225	40	110	1,000 hand brooms, 300 hand scrapers, 17 machine brooms (h. d.), 2 machine brooms (motor driven), 1 pick-up sweeper, 200 can carriers, 5 flush machines (h. d.), 2 flush machines (motor driven), 26 sprinkling wagons (h. d.), 15 squeegees, 31 wagons collect street dirt, 45 carts collect street dirt, 10 snow plows, 2 motor trucks	Bituminous Bus. dist. Concrete, wood block Brick, stone, block Macadam Res. dist.	Flushers—In Bus. dist. owing to vehicles on streets Motor brooms—Distant streets Horse brooms—Close to stables Hand brooms Squeegees—Close to stables	
Florida:							
Sanford	½	4	6	50 hand brooms, 10 hand scrapers, 1 machine broom (horse drawn), 2 can carriers, 1 sprinkling wagon (h. d.), 5 dirt wagons, 1 night soil wagon	.....	.....	
Georgia:							
Albany	12	24	4	48 hand brooms, 24 hand scrapers, 6 pickup sweepers, 20 cans, 1 h. d. sprinkling wagon, 4 dirt wagons, 6 dirt carts	Brick, wood block, macadam Bituminous, stone block	Motor broom Flushing.	Expect to purchase motor broom and flusher
La Grange	6	..	..	12 hand brooms, 1 machine broom (motor driven), 1 flushing machine (motor driven)	Concrete and brick		Flusher
Rome	4	8	..	60 hand brooms, 2 machine brooms (h. d.), 12 can carriers, 1 sprinkling wagon (horse drawn), 1 sprinkling wagon (motor driven), 2 dirt wagons	Bituminous, concrete, brick, stone, wood Macadam		Flusher Flusher Sprinkler
Idaho:							
Caldwell	1⅛	..	..	1 hand broom, 1 pickup sweeper, 1 flush machine (motor driven), 2 sprinkling wagons (h. d.), 1 sprinkling wagon (motor driven), 2 dirt wagons	.....	.....	
Pocatello	1.9	8.6	15	24 hand brooms, 1 machine broom (motor driven), 3 can carriers, 1 flush machine (h. d), 2 flush machines (motor driven), 1 sprinkling wagon (h. d.), 2 dirt wagons, 3 snow plows	Bituminous Concrete Bus. dist. Res. dist.	Flushing—Appearance, low cost, combination flush and sprinkling most useful	
Illinois:							
Blue Island	..	..	..	36 hand brooms, 1 machine broom (h. d.), 1 sprinkling wagon (h. d.), 4 dirt wagons, 5 snow plows	Bituminous, Macadam Bus. & Res. dist.	Hand brooms	Horse drawn would tear up pavement
Canton	..	..	..	12 hand brooms, 1 machine broom (h. d.), 4 can carriers, 1 sprinkling wagon (h. d), 3 dirt wagons, 2 snow plows	Brick, concrete, stone— Concrete, brick Bus. & Res. dist.	Machine brooms Hand brooms	Machine brooms Hand brooms more accessible at curb because of parking cars
Chicago	400	300	500	2,880 hand brooms, 1,070 hand scrapers, 5 gutter brooms, 11 pickup sweepers, 800 can carriers, 70 scrapped flush machines, 18 flush machines (motor driven), 25 snow plows	Macadam	Hand brooms—more economical	
Decatur	2	5	2	24 hand brooms, 12 hand scrapers, 3 h. d. flushing machines, 1 sprinkling wagon (h. d.), 5 dirt wagons, 2 dirt trucks, 5 snow plows	Bit. conc., res. dist. Brick, bus. dist.	Flusher Sweeper	Less expense to operate
Galesburg	..	..	..	24 hand brooms, 3 hand scrapers, 2 h. d. machine brooms, 4 can carriers, 12 cans, 1 h. d. sprinkling wagon, 3 dirt wagons, 4 snow plows	.....	.....	
Metropolis	..	..	..	1 sprinkling wagon (h. d.)	.....	.....	
Monmouth	..	..	..	36 hand brooms, 2 hand scrapers, 1 dirt wagon	.....	.....	
Oak Park	1	2	85	11 hand brooms, 1 pickup sweeper, 2 can carriers, 4 dirt wagons, 1 motor, 1 steel and 20 wooden snow plows	Bit., conc., brick, macadam, bus.-res. dist.	Hand brooms	
Indiana:							
Anderson	10	2	..	36 hand brooms, 2 machine brooms (h. d.), 1 h. d. flushing machine, 2 h. d. sprinkling wagons, 4 dirt wagons, 4 snow plows	.....	.....	
Bedford	1	4	60	12 hand brooms, 1 h. d. sprinkling wagon, 3 dirt trucks	.....	.....	
Brazil	2	5	10	16 hand brooms, 1 h. d. machine broom, 2 dirt wagons, 2 snow plows	.....	.....	

STREET CLEANING—(Continued)

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Indiana (Continued):						
Columbus	..	..	..	18 hand brooms, 5 hand scrapers, 1 h. d. machine broom, 1 h. d. flushing machine, 1 h. d. sprinkling wagon, 2 dirt wagons	.....	.....
Indianapolis	120	200	210	720 hand brooms, 250 hand scrapers, 20 h. d. machine brooms, 100 white wing carts, 200 cans, 4 motor flushing machines, 8 h. d. sprinkling wagons, 8 squeegees (not used), 40 dirt wagons, 50 dirt carts, 4 snow plows	Bit., conc., wood Macadam	Flushers preferred as more efficient and sanitary Brooms
Lebanon	1	2	..	1 machine broom (h. d.)	.....	.....
Mishawaka	..	..	..	12 hand brooms, 6 hand scrapers, 2 h. d. machine brooms, 2 can carriers, 5 dirt wagons, 16 snow plows	.....	.....
Peru	1	6	..	36 hand brooms, 1 machine broom (h. d.), 1 pickup sweeper, 1 vacuum cleaner, 1 h. d. flushing machine, 1 dirt wagon, 12 snow plows	All kinds	Sweeping, to prevent flushing dirt into sewers
Richmond	..	..	..	2 h. d. machine brooms, 1 h. d. sprinkling wagon	.....	.....
Shelbyville	..	2	..	24 hand brooms, 6 hand scrapers, 1 h. d. machine broom, 12 street cans, 1 h. d. sprinkling wagon, 2 dirt wagons, 6 snow plows	.....	.....
South Bend	..	..	..	60 hand brooms, 12 hand scrapers, 4 motor machine brooms, 2 Elgin sweepers, 2 Elgin gutter machines, 16 can carriers, 50 street cans, 1 motor flushing machine, 1 motor sprinkling wagon, 6 dirt wagons, 30 snow plows	.....	.....
Valparaiso	1	6	18	12 hand brooms, 1 h. d. machine broom, 1 dirt cart, 6 snow plows	.....	Machine brooms after a rain
Wabash	10½	..	..	24 hand brooms, 7 hand scrapers, 4 street cans, 1 h. d. sprinkling wagon, 1 dirt wagon, 4 dirt carts, 6 snow plows	All kinds	Pickup sweeper; hand brooms for business dist.
Iowa:						
Marshalltown	2	5	40	24 hand brooms, 12 cans, 1 motor flushing machine, 4 dirt wagons	.....	.....
Mason City	..	..	..	20 hand brooms, 12 hand scrapers, 1 h. d. machine broom, 1 h. d. sprinkling wagon, 4 dirt wagons, 2 snow plows	.....	.....
Red Oak	..	..	..	12 hand brooms, 1 h. d. machine broom, 20 street cans, 1 h. d. sprinkling wagon	All kinds	Machine brooms best for small city
Kansas:						
Salina	10	2	..	36 hand brooms, 1 h. d. machine broom, 1 gutter sweeping machine, 6 can carriers, 20 street cans, 1 h. d. flushing machine, 1 motor flushing machine, 2 h. d. sprinkling wagons, 1 motor sprinkling wagon, 10 dirt wagons, 4 dirt carts	.....	.....
Kentucky:						
Bowling Green	2	..	..	36 hand brooms, 36 hand scrapers, 1 h.d. machine broom, 4 pickup sweepers, 4 can carriers, 50 street cans, 4 dirt trucks	All kinds	Motor sweeper, because of cost
Fort Thomas	..	..	..	12 hand brooms, 1 h. d. sprinkling wagon	.....	.....
Frankfort	..	4	..	24 hand brooms, 1 h. d. machine broom, 1 h. d. flushing machine, 1 h. d. sprinkling wagon, 2 dirt wagons, 1 snow plow	.....	Flush dirt into gutter and pick up by hand
Madisonville	0.9	2	14	24 hand brooms with scrapers, 2 h. d. machine brooms, 2 can carriers, 4 street cans, 1 h. d. sprinkling wagon	.....	Flusher more sanitary
Paducah	..	..	..	15 hand brooms, 6 hand scrapers, 1 h. d. machine broom, 1 can carrier, 4 street cans, 2 h. d. flushing machines, 2 h. d. sprinkling wagons, 7 dirt wagons, 1 dirt cart, 2 snow plows	Bit., conc., brick Wood block, macadam	Flusher Machine broom—Flushing injures these
Winchester	..	..	..	Hand brooms, scrapers, dirt wagons and dirt carts—numbers not given	.....	.....
Maine:						
Oldtown	0.1	..	..	24 hand brooms, 3 hand scrapers, 15 cans, 1 h. d. sprinkling wagon, 1 dirt wagon, 4 snow plows	.....	.....
So. Portland	..	..	..	12 hand brooms, 1 h. d. machine broom	.....	.....
Maryland:						
Hagerstown	5	25	50	100 hand brooms, 5 can carriers, 10 street cans, 1 motor flushing machine, 1 h. d. sprinkling wagon, 1 motor sprinkling wagon, 3 trucks	.....	.....
Massachusetts:						
Adams	4	..	..	36 hand brooms, 1 h. d. machine broom, 1 motor machine broom, 6 can carriers, 24 cans, 1 h. d. sprinkling wagon, 1 dirt cart, 6 snow plows	Bit., concr., brick, stone blk., wood blk. Macadam	Motor broom—Gives perfect satisfaction. H. d. sweeper.

Andover	..	..	..	10 hand brooms, 1 h. d. machine broom, 2 h. d. sprinkling wagons, 1 dirt cart, 1 "hokey-poky" cart, 10 snow plows	.....	.....
Athol	1	6	..	10 hand brooms, 1 h. d. machine broom, 6 cans, 4 h. d. sprinkling wagons, 2 dirt wagons, 3 dirt carts, 6 snow plows	.....	.....
Concord	0.5	2	30	30 hand brooms, 1 h. d. machine broom, 10 cans, 1 h. d. sprinkling wagon, 3 dirt carts, 13 h. d. snow plows, 3 auto snow plows	Bit.	Hand broom—Less dust.
Dartmouth	..	..	14	45 hand brooms, 2 h. d. machine brooms, 2 h. d. sprinkling wagons, 12 dirt carts, 2 snow plows	.....	.....
Dracut	1	..	15	12 hand brooms, 1 h. d. machine broom, 1 h. d. sprinkling wagon, 6 snow plows	.....	.....
Haverhill	15	..	..	50 hand brooms, 1 h. d. machine broom, 1 Elgin sweeper with gutter sweeper, 20 can carriers, 1 motor flushing machine and sprinkler, 3 dirt wagons, 15 snow plows	.....	.....
Holyoke	..	..	..	150 hand brooms, 15 hand scrapers, 2 h. d. machine brooms, 15 can carriers, 200 cans, 1 motor flushing machine, 6 h. d. sprinkling wagons, 1 motor sprinkling wagon, 1 squeegee, 12 dirt wagons, 12 dirt carts, 15 snow plows	Macadam All others.	H. d. broom. Flusher, cheaper.
Hudson	75	..	..	24 hand brooms, 1 h. d. machine broom, 1 can carrier, 30 cans, 1 h. d. sprinkling wagon, dirt carts, 6 snow plows	Bit. macadam	Hand brooms daily; h. d. sweeper once a month.
Ludlow	..	..	4	6 hand brooms, 2 cans, 1 h. d. sprinkling wagon, 4 snow plows	.....	.....
Malden	5	..	..	144 hand brooms and scrapers, 2 h. d. machine brooms, 1 motor machine broom, 1 pickup sweeper, 4 can carriers, 24 cans, 1 motor flushing machine, 2 road snow plows, 2 sidewalk snow plows	.....	.....
Mansfield	..	..	..	6 hand brooms, 1 hand cart	.....	.....
Medford	5	10	40	60 hand brooms, 1 h. d. machine broom, 6 pickup sweepers, 2 gutter sweepers, 6 can carriers, 10 cans, 1 motor flushing machine, 2 h. d. sprinkling wagons, 6 dirt wagons, 21 snow plows	Bit., concr. stone blk., wood blk.	Motor.
Newburyport	5	5	20	30 hand brooms, 20 hand scrapers, 1 h. d. machine broom, 4 can carriers, 16 cans, 2 h. d. sprinkling wagons, 5 dirt wagons, 5 dirt carts, 7 snow plows	.....	.....
Newton	55	15	60	50 hand brooms, 3 h. d. machine brooms, 1 motor machine broom, 1 pickup sweeper, 25 cans, 1 motor flushing machine, 3 h. d. sprinkling wagons, 1 motor sprinkling wagon, 6 dirt carts and wagons, 50 snow plows	.....	.....
No. Attleboro	0.4	..	..	36 hand brooms, 24 hand scrapers, 1 can carrier, 8 cans, 1 h. d. sprinkling wagon, 2 dirt wagons, 2 dirt carts, 16 snow plows	.....	Motor broom for brk., h. d. broom for mac.
Orange	..	..	..			
Rockland	2	7	..	1 dirt wagon, 6 snow plows 6 hand brooms, 25 snow plows	..... Business dist.	..... Hand brooms only.
Watertown	..	..	..	36 hand brooms, 1 machine broom (h. d.), 1 sprinkling wagon (h. d.), 10 dirt wagons, 10 dirt carts, 18 snow plows	.....	.....
Winchester	..	..	..	60 hand brooms, 2 h. d. machine brooms, 1 can carrier, 3 h. d. sprinkling wagons, 8 dirt carts, 12 snow plows	Bituminous and macadam	H. d. machine broom.
Michigan:						
Alma	3	3	40	1 h. d. flushing machine, 2 h. d. sprinkling wagons, 3 dirt wagons, 4 snow plows	Bit., conc., brick	Flusher—Minimum expense.
Ann Arbor	5	20	..	24 hand brooms, 1 pickup sweeper, 1 h. d. sprinkling wagon, 2 dirt wagons, 14 snow plows	Bit., conc., brick, wood, business dist.	Pickup sweeper—Cheapest.
Detroit	30	750	..	720 hand brooms, 120 hand scrapers, 40 h. d. machine brooms, 10 motor-driven machine brooms, 5 pick up sweepers, 215 can carriers, 14 h. d. flush machines, 5 motor-driven flush machines, 3 h. d. sprink wagons, 5 dirt wagons, 8 snow plows	.....	.....
Highland Park	16	48	..	2 pickup sweepers, 1 gutter sweeper, 50 cans, 1 dirt truck.	.....	.....
Holland	9	..	..	12 hand brooms, 5 hand scrapers, 1 h. d. mach. broom, 1 h. d. flush. mach., 1 motor-driven flush. mach., 4 sprink. wagons (h. d.), 8 snow plows	.....	.....
Ishpeming	27	..	..	12 hand brooms, 6 hand scrapers, 1 h. d. mach. broom, 1 motor-driven sprink. wagon, 1 dirt wagon, 6 dirt carts, 4 snow plows, trucks	Conc., brick, stone, wood, macadam, business.	Truck.
Jackson	5	5	..	50 hand brooms, 2 h. d. mach. brooms, 2 can carriers, 1 m. d. flush. mach., 2 h. d. sprink. wagons, 6 dirt wagons.	Bit., conc., brick.	Flusher—No experience with other equip.
Kalamazoo	8	4	20	24 hand brooms, 6 hand scrapers, 3 h. d. machine brooms, 1 motor machine broom, 10 pickup sweepers, 6 cans, 1 h. d. sprinkling wagon, 4 dirt wagons, 30 snow plows.	Bit., wood, macadam, concr., brick, stone	Sweeper.
Lansing	10	..	..	72 hand brooms, 6 hand scrapers, 1 h. d. mach. broom, 1 m. d. mach. broom, 1 pickup sweeper, 1 gutter sweeper, 6 can carriers, 1 h. d. flush mach., 16 h. d. sprink wagons, 4 m. d. sprink. wagons, 4 dirt wagons, 48 snow plows.	Bit., bus. dist. Conc., brick	Motor-driven. Horse-drawn.

STREET CLEANING—(Continued)

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Michigan (Continued):						
Ludington	4	2	..	2 hand brooms, 2 hand scrapers, 2 snow plows.	Bit. Macadam All kinds	Scraper. Broom—More efficient. Flusher, dustless.
Monroe	5	3	..	1 h. d. machine broom, 1 motor machine broom, 30 cans, 1 h. d. sprink. wagon, 2 dirt wagons, 6 snow plows.		
Muskegon	5	5	10	24 hand brooms, 6 hand scrapers, 1 h. d. mach. broom, 1 m. d. mach. broom, 1 pickup sweeper, 1 gutter sweeper, 1 h. d. flush mach., 1 h. d. sprink. wagon, 4 dirt wagons, 3 dirt carts.	Brick Stone, wood, mac.	Hand sweeper. Motor sweeper.
Niles	1	8	..	1 h. d. mach. broom, 2 dirt carts, 6 snow plows.	Bus. district.	Carts.
Pontiac	10	..	..	48 hand brooms, 36 hand sweepers, 1 h. d. mach. broom, 3 can carriers, 1 m. d. flush. mach., 4 dirt wagons, 14 snow plows.	Bituminous, concrete Brick, stone, wood.	Flusher. Sweeper—Not injurious.
Sturgis	..	12	..	1 h. d. mach. broom, 4 can carriers, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 2 dirt wagons, 2 snow plows.	Bit., wood & res. dist., Brick, stone, bus. dist.	Pickup sweeper. Flusher—Best where practicable.
Minnesota:						
Austin	..	5	..	6 hand brooms, 3 hand scrapers, 1 h. d. mach. broom, 1 m. d. flush. mach., 6 dirt wagons, 5 one-horse snow plows, 2 F. W. D. trucks part time.	Brick & wood.	Flusher.
Rochester	10	25	40	1 h. d. flush. mach., 1 m. d. flush. mach., 5 h. d. sprink. wagons, 1 m. d. sprink. wagon, 4 dirt wagons, 10 snow plows.	Bit. conc., brick, wood, business & res.	Flusher.
St. Paul	..	..	..	110 hand brooms, 96 hand scrapers, 181 cans, 7 h. d. flush. machines, 3 motor combined flusher and sprinkler, 106 h. d. sprink. wagons, 4 dirt wagons, 32 snow plows.	All kinds.	Flushing only proper and economical method.
Mississippi:						
Vicksburg	..	..	..	36 hand brooms, 1 motor flushing machine, 3 dirt carts.	.....	.....
Missouri:						
Cape Girardeau	12	..	..	36 hand brooms, 6 can carriers.	.....	.....
Columbia	..	..	..	10 hand brooms, 1 h. d. mach. broom, 1 can carrier, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 2 dirt wagons, 2 snow plows.	.....	.....
Fulton	..	½	..	12 hand brooms, 1 h. d. machine broom, 10 cans, 1 h. d. sprink. wagon, 2 dirt wagons, 1 snow plow, fire hose.	Brick.	Use machine broom, prefer flusher—Less dust.
Joplin	10	10	..	4 hand brooms, 1 pickup sweeper, 1 dirt wagon.	.....	.....
Kansas City	15	175	510	400 hand brooms, 2 h.d. machine brooms, 1 Elgin cleaner, 1 Elgin gutter sweeper, 50 can carriers, 1,100 cans, 21 h.d. flushing machines, 2 h.d. sprinkling wagons, 4 dirt wagons, 45 dirt carts, 6 snow plows.	Wood block and macadam All other pavements	Hand brooms Elgin cleaner
Sedalia	2	3	..	24 hand brooms, 1 h. d. mach. broom, 2 can carriers, 1 h. d. flush. mach., 2 dirt wagons, 1 dirt cart.	.....	.....
Montana:						
Kalispell	2	..	..	4 hand brooms, 1 h.d. mach. broom, 4 h.d. sprink wagons, 2 dirt carts, 5 snow plows.	Bituminous.	Flushing machines.
Nebraska:						
Hastings	2	5	20	14 hand brooms, 1 h.d. mach. broom, 3 dirt wagons, 4 snow plows.	.....	.....
New Hampshire:						
Franklin	1	1	..	12 hand brooms, 2 hand scrapers, 1 h.d. mach. broom., 2 pickup sweepers, 2 can carriers, 1 h.d. sprink wagon, 1 dirt cart, 6 snow plows.	.....	Hand broom only necessary.
Nashua	..	..	..	1 h.d. mach. broom, 1 Elgin sweeper, 20 snow plows.	.....	Elgin sweeper on all.
New Jersey:						
Asbury Park	2	..	..	72 hand brooms and scrapers, 4 can carriers, 8 motor sprink. wagons, 5 dirt wagons, 8 snow plows.	All paved streets.	Hand sweeping.
Atlantic City	50	34	..	100 hand brooms, 16 hand scrapers, 2 m.d. flush. mach., 8 h.d. sprink. wagons, 1 m.d. sprink. wagon, 6 snow plows, 15 hand trucks.	.....	.....

Hackensack	8	..	..	1 Elgin sweeper, 1 h.d. flush. machine, 1 h.d. sprink. wagon, 2 dirt carts, 2 snow plows.	Bit., concr., brick, stone. Macadam.	Elgin at night. Hand brooms.
Newark	35	225	22	350 hand brooms, 150 hand scrapers, 1 m.d. mach. broom, 20 can carriers, 3 h.d. flush. mach., 4 m.d. flush. mach., 3 h.d. sprink. wagons, 40 dirt wagons, 9 snow plows.	Macadam & some stone blk. All others.	Hand brooms. ..... Motor flusher—Insures clean pavements.
Phillipsburg	2	..	31	15 hand brooms, 2 can carriers, 6 cans, 1 h.d. sprink. wagon.	Concr., brick, stone.	Hand brooms.
Roselle Park.....	..	..	4	6 hand brooms, 1 h.d. mach. broom, 1 h.d. sprink. wagon, 1 dirt wagon, 2 dirt carts, 2 snow plows.	All impvd. concrete.	.....
Salem	..	..	..	4 hand brooms, 1 h.d. mach. broom, 2 h.d. sprink wagons.	.....	.....
Westfield	2	10	20	24 hand brooms, 1 h.d. mach. broom, 3 can carriers, 1 h.d. sprink. wagon, 2 dirt wagons, 2 dirt carts, 3 snow plows.	.....	.....
West Orange.....	..	..	11	24 hand brooms, 24 hand scrapers, 1 h.d. mach. broom, 1 m.d. mach. broom, 6 can carriers, 1 h.d. sprink. wagon, 3 dirt wagons, 2 dirt carts, 4 snow plows.	Bit., conc., stone, macadam, bus. dist.	Motor sweeper.
New York:						
Amsterdam	10	6	..	96 hand brooms, 96 hand scrapers, 2 h.d. mach. brooms, 1 m.d. mach. broom, 1 pickup sweeper, 1 vacuum str. cleaner, 1 gutter sweeper, 12 can carriers, 1 h.d. sprink. wagon, 12 squeegees, 6 dirt wagons, 15 dirt carts, 1 snow plow.	.....	.....
Auburn	..	..	..	24 hand brooms, 36 hand scrapers, 1 h.d. mach. broom, 10 can carriers, 1 m.d. flush. mach., 2 h.d. sprink. wagons, 1 Ford truck, 1 Mack 5-ton truck (part time).	.....	.....
Buffalo	465*	..	..	225 hand brooms and scrapers, 25 h.d. machine brooms, 80 can carriers, 30 cans, 15 motor flush. mach., 7 h.d. sprink. wagons, 85 dirt wagons, 15 snow plows.	.....	.....
Cortland	1	4	15	18 hand brooms, 10 hand scrapers, 2 h.d. sprink. wagons, 4 dirt wagons, 6 snow plows.	Bit., bus. dist. Brick, macadam, res. dist.	Brooms Scrapers
Hempstead	2	5	15	12 hand brooms, 2 hand scrapers, 1 h.d. mach. broom, 1 m.d. mach. broom, 1 can carrier, 1 m.d. sprink. wagon, 3 dirt wagons, 3 dirt carts, 1 snow plow.	.....	.....
Johnson City.....	4	5.5	..	12 hand brooms, 8 hand scrapers, 5 can carriers, 1 m.d. flush. mach., 1 h.d. sprink. wagon, 2 dirt wagons, 1 snow plow.	Macadam	Sweeper
Kingston	25	25	50	60 hand brooms and scrapers, 2 h.d. machine brooms, 25 can carriers, 50 cans, 2 h.d. flush. mach., 1 motor flushing mach., 1 h.d. sprink. wagon, 1 squeegee, 3 dirt wagons, 1 snow plow.	All others Bituminous Conc. & macadam Brick & wood block Stone block Business dist.	Flusher. Motor flusher and white wings Flusher Flusher and sweeper Sweeper White wings
New York (Manhattan, Brooklyn and Bronx Boroughs)	1,600	..	..	3,000 hand brooms, 15,000 hand scrapers, 132 h.d. machine brooms, 3,400 can carriers, 21,500 cans, 87 motor flushers, 99 h.d. sprinkling wagons, 30 squeegees, 110 bottom-dump wagons, 2 snow loading machines, 300 push snow plows, 129 5-ton trucks, 12 7.5-ton trucks, 100 2-ton trucks, 129 tractors,	.....	.....
Ossining	5	4	..	4 hand brooms, 1 h.d. mach. broom, 1 h.d. sprink. wagon, 3 dirt wagons, 2 snow plows.	.....	Pickup sweeper on all—Removes all refuse at one operation
Rockville Centre..	..	..	..	12 hand brooms, 2 hand scrapers, 1 m.d. mach. broom, 2 can carriers, 1 h.d. sprink. wagon, 2 dirt wagons.	All	Hand broom—More sanitary and neat
Saratoga	2	..	..	25 hand brooms, 3 h.d. mach. brooms, 6 pickup sweepers, 18 cans, 1 h.d. flush. mach., 6 h.d. sprink. wagons, 6 dirt wagons.	Bit., conc., brick, stone, wood Macadam	Flusher Brooms
Tarrytown	¼	3	..	30 hand brooms, 1 h.d. mach. broom, 1 can carrier, 2 h.d. sprink. wagons, 5 snow plows.	Bit., brick, mac., bus. & res.	Hand broom
Watertown	10	3	..	12 hand brooms, 1 gutter sweep., 3 can carriers, 1 dirt wagon	.....	Elgin str. sweeper on all smooth surfaces; does not clog catch basins nor sewers.
North Carolina:						
Durham	2	6	..	2 hand brooms, 1 h.d. mach. broom, 1 pickup sweeper, 1 gutter sweeper, 2 can carriers, 1 m.d. flush. mach., 2 h.d. sprink. wagons, 1 m.d. spr. wagon, 3 dirt wagons, 12 dirt carts.	.....	.....
Elizabeth City....	2	8	1	72 hand brooms, 1 m.d. mach. broom, 2 pickup sweepers, 1 h.d. sprink. wagon, 4 dirt wagons, 4 dirt carts.	Bit. & conc.	Truck
Fayetteville	10	25	5	36 hand brooms, 6 hand scrapers, 1 m.d. mach. broom, 5 can carriers, 1 m.d. sprink. wagon, 3 dirt wagons, 3 dirt carts.	Bit., conc., stone, bus. and res. dist. Brick, wood block	Flusher—Sanitary and cheaper Broom
Greensboro	..	..	..	120 hand brooms, 150 cans, 1 h.d. flush. mach., 1 motor flush. mach., 1 h.d. sprink. wagon, 1 motor sprink. wagon, 8 dirt wagons, 4 dirt carts.	.....	.....
Henderson	1	3	6	48 hand brooms, 48 hand scrapers, 1 h.d. mach. broom, 1 h.d. sprink. wagon, 1 dirt wagon.	Bituminous Conc., brick	Vacuum Flusher.
Wilmington	3	15	..	2 h.d. mach. brooms, 1 m.d. flush. mach., 1 h.d. sprink wagon, 3 dirt wagons, 6 dirt carts.	Bit., bus. & res. dist. Brick & stone block	Flusher—Saves expense of pickup. Broom

*275 miles of street cleaning and 190 miles of flushing per day.

STREET CLEANING—(Continued)

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred	
North Dakota:							
Jamestown	20 blks.	..	..	2 hand brooms, 2 hand scrapers, 2 dirt wagons, 1 dirt cart, 1 flusher and sprinkler, 1 snow plow.	Bit., mac., bus. dist. Conc., wood blk. Brick, stone blk. Res. dist.	Flusher Pickup sweeper Machine broom Sprinkler	Different equipment does better work under different conditions.
Ohio:							
Akron	..	..	..	96 hand brooms, 6 m.d. mach. brooms, 3 pickup sweepers, 2 gutter sweepers, 100 can carriers, 2 m.d. flush. mach., 7 2-ton motor trucks, 10 snow plows.	.....	Motor on all; easier on pavements; better work; low cost.	
Ashland	2	..	..	12 hand brooms, 1 h. d. mach. broom, 6 pickup sweepers, 2 dirt wagons, 6 snow plows	.....	.....	
Ashtabula	5	11	..	260 hand brooms, 6 hand scrapers, 2 h. d. mach. brooms, 3 can carriers, 3 h. d. sprink. wagons, 4 dirt wagons, 1 dirt cart, 14 snow plows, 72 shovels, 12 catch basin spoons	.....	Brooms, because they clean better	
Bellefontaine	1½	2	..	6 hand brooms, 3 hand scrapers, 2 snow plows	.....	.....	
Bucyrus	..	15	20	24 hand brooms, 3 hand scrapers, 2 h. d. mach. brooms, 1 motor d. mach. broom, 1 dirt wagon, 1 dirt cart, 6 snow plows	.....	Motor on all—cheaper operation	
Chillicothe	6	9	5	24 hand brooms, 36 hand scrapers	.....	Motor driven machine broom on all	
Cincinnati	15	30	30	200 hand brooms, 200 hand scrapers, 2 pickup sweepers, 50 can carriers, 2 h. d. flush. mach., 4 motor d. flush. mach., 15 dirt wagons, 6 snow plows	Bit., brick, wood, bus. and res. dist. Macadam	Flushing machine Pickup sweeper	
Circleville	..	3	..	24 hand brooms, 1 h. d. mach. broom, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 1 dirt wagon, 1 snow plow	.....	Hand broom—can sweep till clean	
Dayton	5	..	..	21 hand scrapers, 14 can carriers, 1 motor d. flush. mach., 5 dirt wagons, 4 snow plows, 3 pick trucks	.....	.....	
Delaware	..	9	..	24 hand brooms, 1 h. d. mach. broom, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 6 snow plows	Bit., conc., brick, stone, bus. and res. dist. Wood block Macadam	Flusher Sweeper Sprinkler	Best results
Fremont	..	..	..	12 hand brooms, 1 h. d. mach. broom, 1 h. d. sprink. wagon, 2 dirt carts	.....	.....	
Galion	2	1	8	36 hand brooms, 6 hand scrapers, 6 can carriers, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 1 dirt cart, 6 snow plows	Brick, stone, macadam Bus. dist. Res. dist.	Hand broom White wings Flusher	
Newark	3-5	..	..	36 hand brooms, 12 hand scrapers, 1 h. d. mach. broom, 1 h. d. flush. mach., 3 dirt wagons, 1 dirt cart, 1 snow plow	Bit., brick, bus. and res. dist.	Flusher—no dust—cleans better	
Portsmouth	6	..	..	6 hand brooms, 6 hand scrapers, 2 h. d. mach. brooms, 1 h. d. sprink. wagon, 2 dirt wagons, 1 snow plow	.....	Only brick pavements	
Sidney	9	..	..	12 hand brooms, 5 hand scrapers, 1 h. d. flush. mach., 2 dirt wagons	.....	.....	
Urbana	2	2	..	12 hand scrapers, 1 h. d. mach. broom, 3 can carriers, 1 h. d. flush. mach., 3 h. d. sprink. wagons, 3 dirt carts, 3 snow plows	Bit., conc., br., mac., bus. and res. dist.	Flusher—more sanitary—cheaper—cleaner	
Wilmington	..	..	..	6 hand brooms, 2 hand scrapers, 1 h. d. mach. broom, 1 cart, 1 h. d. sprink. wagon, 3 dirt wagons	.....	.....	
Oklahoma:							
Ada	..	2	2	4 hand brooms, 2 hand scrapers, 1 h. d. mach. broom, 1 motor d. flush. mach., 1 h. d. sprink. wagon, 2 dirt wagons, 1 dirt cart	Bit., conc., bus. and res. dist. Macadam	Flusher Sprinkler	
Blackwell	..	..	..	4 hand brooms, 1 h. d. sprink. wagon, 1 dirt wagon, 2 dirt carts	.....	.....	
Enid	1½	6	30	8 hand brooms, 6 hand scrapers, 1 h. d. sprink. wagon, 1 dirt wagon, 3 dirt carts	.....	.....	
Oregon:							
Corvallis	..	..	..	12 hand brooms, 1 h. d. mach. broom, 1 h. d. flush. mach., 1 dirt wagon	.....	.....	
La Grande	1	3	4	6 hand brooms, 6 hand scrapers, 1 h. d. mach. broom, 1 can carrier, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 1 dirt wagon, 1 dirt cart	Bituminous Conc., br., stone, res. dist. Macadam Bus. dist.	Squeegee Pickup sweeper Sprinkler Flusher	
Pendleton	1.2	4.7	13	5 hand brooms, 1 h. d. mach. broom, 1 motor d. flush. mach., 4 h. d. sprink. wagons, 1 motor truck	Bit., res. dist. Conc., bus. dist.	Pickup sweeper Flusher	

Pennsylvania:						
Beaver Falls	..	..	..	24 hand brooms, 1 h. d. machine broom, 12 cans, 1 h. d. flushing machine and sprinkler, 3 dirt wagons	Bit., conc., brick	Machine broom
Bloomsburg	..	..	..	60 hand brooms, 1 dirt truck, 1 snow plow	.....	.....
Carlisle	2	7	..	24 hand brooms, 12 hand scrapers, 4 can carriers, 2 dirt wagons	.....	.....
Coatesville	..	..	..	12-15 hand brooms, 1 h. d. mach. broom, 1 h. d. sprink. wagon, 3 dirt wagons, 1 dirt truck	Asph., br., stone, wood Mac., bus. and res. dist.	Machine broom Hand broom Less dust on macadam
Dormont	..	3	12	12 hand brooms, 1 can carrier, 1 dirt cart, 1 snow plow	.....	.....
Du Bois	1	2	..	24 hand brooms, 1 h. d. mach. broom, 2 can carriers, 1 h. d. flush. mach., 1 h. d. sprink. wagon, 2 dirt wagons, 1 snow plow	.....	.....
Easton	..	..	..	1 h. d. flushing machine, 1 h. d. sprinkling wagon, 1 pickup sweeper	.....	.....
Freeland	..	3	2	24 hand brooms, 10 hand scrapers, 2 can carriers, 2 dirt wagons, 2 dirt carts, 1 snow plow	.....	.....
Greenville	..	..	..	10 hand brooms, 5 hand scrapers, 3 h. d. machine brooms, 1 h. d. flush. machine, 1 h. d. sprink. wagon, 2 dirt wagons	Bit., bus. dis. Conc., brick, stone, wood, macadam	Flusher—cleaner and better Sweeper—cheaper and quicker
Kittanning	1½	..	..	1 h. d. mach. broom, 1 h. d. sprink. wagon, 2 dirt trucks, 2 snow plows	.....	.....
Lebanon	6	10	..	15 hand brooms, 1 h. d. mach. broom, 1 Elgin sweeper	.....	.....
Lewistown	..	..	..	6 hand brooms, 1 dirt truck	.....	.....
Meadville	4	17.82	..	72 hand brooms, 12 hand scrapers, 3 h. d. mach. brooms, 1 Elgin sweeper, 3 can carriers, 1 h. d. sprink. wagon, 2 dirt wagons, 5 snow plows	All brick except 6 mi. asphalt	Sweeper
New Brighton	..	9	..	24 hand brooms, 1 h. d. flush. mach., 1 dirt wagon	.....	.....
No. Braddock	3	5	16	5 hand brooms, 1 h. d. mach. broom, 6 can carriers, 1 h. d. sprink. wagon, 3 dirt wagons	.....	.....
Pittston	6	2	..	24 hand brooms and scrapers, 6 can carriers, 96 cans, 1 h. d. sprink. wagon, 6 dirt wagons, 6 dirt carts	.....	.....
Rankin	2	6	..	50 hand brooms, 10 hand scrapers, 1 h. d. mach. broom, 5 can carriers, 1 h. d. sprink. wagon, 1 dirt wagon	Brick, stone, bus. and res. dist.	Hand broom—rough paving
Summit Hill	..	..	7 approx.	2 dirt trucks, 1 snow plow	.....	.....
W. Pittston	..	..	..	24 hand brooms, 6 hand scrapers, 12 cans, 1 dirt truck, 1 hose cart	.....	.....
Rhode Island:						
Westerly	2	..	6	30 hand brooms, 12 hand scrapers, 1 h. d. mach. broom, 3 can carriers, 1 h. d. flush. mach., 2 dirt wagons, 4 dirt carts, 4 snow plows	.....	.....
South Carolina:						
Spartanburg	5	6	8	24 hand brooms, 2 h. d. mach. brooms, 4 can carriers, 1 motor d. flush. mach., 2 h. d. sprink. wagons, 6 dirt wagons	Bit. conc., bus., res. dist. Brick, stone	Flusher Sweeper — Flusher eliminates dust
Tennessee:						
Memphis	77	40	10	96 hand brooms, 36 hand scrapers, 2500 lbs. fibre, motor d. mach. broom, 2 pickup sweepers, 25 can carriers, 8 h. d. flush. mach., 1 motor d. flush. mach., 21 h. d. sprink. wagons, 16 dirt carts	.....	Elgin and flusher preferred—one picks up heavy dust—other flushes fine
Morristown	..	..	..	100 hand brooms, 4 hand scrapers, 1 h. d. mach. broom, 1 h. d. flush. mach., 1 h. d. sprink wagon	Bit., conc., br., bus. and res. dist. Macadam	Motor driven sweeper Hand brush
Texas:						
Beaumont	20	20	..	12 hand brooms, 12 hand scrapers, 4 can carriers, 2 motor d. flush. mach., 6 dirt wagons, 2 dirt carts	Bit., conc., wood bl. Bus. dist. Res. dist.	Flushers—pickup Hand equipment Motor equipment — Cleanliness and appearance of equipment
Dallas	70	130	211	24 hand brooms, 48 hand scrapers, 3 Elgin sweepers, 36 can carriers, 6 m.d. flush. mach., 4 h.d. sprink. wagons, 2 m.d. sprink. wagons, 10 dirt wagons, 18 dirt carts, 20 motor trucks, dump bodies.	Bituminous	Flushers
Eagle Pass	..	..	..	24 hand brooms, 1 h.d. mach. broom, 2 can carriers, 1 h.d. sprink. wagon, 3 dirt wagons, 1 Ford truck & Peerless truck.	Bit., bus. dist. Macadam, res. dist.	Street sweeper Hand brooms
McKinney	..	..	..	1 h.d. mach. broom, 1 h.d. sprink. wagon, 1 dirt wagon.	.....	.....
Utah:						
Brigham	..	½	..	4 hand brooms, 1 comb. flush. & sprink. mach. (m.d.), 1 snow plow.	Bit., bus. dist.	Flusher
Vermont:						
Bennington	1	..	4	3 hand brooms, 1 h.d. mach. broom, 2 h.d. sprink wagons, 2 dirt wagons, 4 snow plows.	Bit., concrete	Hand brooms
Burlington	1	2	60	48 hand brooms and scrapers, 1 h.d. mach. broom, 6 can carriers, 13 h.d. sprink. wagons, 6 dirt wagons, 4 dirt carts, 13 snow plows.	.....	.....

STREET CLEANING—(Continued)

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Vermont—Continued						
Rutland	3	..	..	10 hand brooms, 2 hand scrapers, 1 h.d. mach. broom, 1 h.d. flush. mach., 2 h.d. sprink. wagons, 3 dirt wagons, 12 snow plows.	Bit., conc., br., bus. dist. Macadam, res. dist.	Flushing machine Sprinkler
Virginia:						
Bristol	2	2	..	24 hand brooms, 1 h.d. mach. broom, 1 h.d. flush. mach. & sprink. wagon (comb.), 2 dirt wagons.	.....	.....
Danville	4	25	..	Large No. hand brooms, 1 h.d. mach. broom, 1 pickup sweeper, 1 can carrier, 1 h.d. sprink. wagon, 2 dirt wagons.	.....	.....
Fredericksburg	1	7	10	20 hand brooms, 2 h.d. mach. brooms, 2 can carriers, 2 h.d. sprink. wagons, 2 dirt trucks, 1 snow plow.	.....	Pickup sweeper if finances permitted
Lynchburg	4	8	40	72 hand brooms, 2 h.d. mach. brooms, 4 can carriers, 3 h.d. sprink. wagons, 2 dirt wagons, 2 snow plows, 3 Ford trucks.	Bit., conc., br., wood, bus. & res. dist. Stone block	Pickup sweeper Machine brooms
Newport News	15	12	9	96 hand brooms, 3 h.d. mach. brooms, 1 can carrier, 1 h.d. sprink. wagon, 4 dirt carts.	Bit., conc., br., res. dist. Macadam, bus. dist.	Machine brooms } Efficiency Hand brooms }
Petersburg	5	13	10	3 h.d. mach. brooms, 1 mach. broom tractor, 1 pickup sweeper, 3 h.d. sprink wagons, 6 dirt carts.	Bit., conc., br., stone, wood, res. dist. Macadam Bus. dist.	Motor sweeper Tractor sweeper Patrol
Richmond	13.7	133	11	120 hand brooms, 24 hand scrapers, 4 h.d. machine brooms, 2 motor machine brooms, 2 pickup sweepers, 25 can carriers, 32 cans, 3 motor flushers, 2 h.d. sprink. wagons, 14 dirt carts, 4 snow plows.	.....	.....
Roanoke	4	36	..	7 hand brooms, 1 h.d. comb. mach. broom & sprinkler, 3 can carriers, 1 dirt wagon, 2 dirt carts.	.....	.....
Washington:						
Seattle	....	..	..	106 hand brooms, 50 hand scrapers, 60 can carriers, 1,200 cans, 14 h.d. flushing machines, 2 motor flushers, 3 h.d sprink. wagons, 1 squeegee, 55 dirt wagons, 2 dirt carts.	.....	.....
Spokane	30	10	..	20 hand brooms and scrapers, 4 motor machine brooms, 1 pickup sweeper, 1 gutter machine, 20 cans, 4 motor flushing machines, 10 h.d. sprink. wagons, 15 motor sprink. wagons, 1 snow plow.	.....	.....
Walla Walla	4	24	..	4 hand brooms, 1 hand scraper, 1 can carrier, 2 h.d. flush. mach., 2 m.d. flush. mach., 12 h.d. sprink. wagons, 2 m.d. sprink. wagons, 1 squeegee, 2 dirt wagons, 2 dirt carts, 8 h.d. snow plows.	.....	
West Virginia:						
Charleston	5	..	..	4 hand brooms, 4 can carriers, 2 h.d. flush. mach., 1 m.d. flush mach., 1 h.d. sprink. wagon, 7 dirt wagons, 3 dirt carts, 2 snow plows, 3 motor trucks.	Bit., bus. & res. dist. Conc., brick, macadam.	Flusher Sweepers
Clarksburg	7	18	45	36 hand brooms, 1 m.d. machine broom, 1 pickup sweeper, 1 gutter sweeper, 2 can carriers, 450 ft. hose & cart.	.....	Elgin—Most economical
Huntington	..	..	..	7 hand brooms, 1 m.d. machine broom, 1 pickup sweeper, 1 gutter sweeper, 1 h.d. sprink. wagon, 3 dirt wagons, 7 dirt carts.	Bit., conc., res. dist. Brick, macadam. Bus. dist.	Flushing machine Sweepers Push broom
Wisconsin:						
Ashland	9	1	..	24 hand brooms & scrapers, 1 h.d. mach. broom, 36 cans, 1 h.d. flush. mach., 3 h.d. sprink. wagons, 6 dirt wagons, 2 snow plows.	.....	.....
Green Bay	22	13	none	72 hand brooms & scrapers, 1 motor machine broom, 35 can carriers, 35 cans, 3 h.d. sprink. wagons, 6 dirt wagons, 3 snow plows.	Bit. or conc. Mac., & bus. dist.	Hand or machine brooms Hand brooms
Menasha	4	..	1	1 h.d. machine broom, 9 can carriers, 1 dirt wagon, 9 dirt carts, 1 snow plow.	.....	.....
Racine	7	43	..	32 hand brooms, 10 hand scrapers, 2 m.d. mach. brooms, 1 pickup sweeper, 1 gutter sweeper, 32 can carriers, 2 m.d. flush. mach., 12 dirt wagons, 32 dirt carts 2 snow plows.	Bit., wood, bus. dist. Conc., br., res. dist.	Hand broom—Can work with traffic Machine broom
Sheboygan	..	41	..	144 hand brooms, 36 hand scrapers, 1 m.d. flush. mach., 3 dirt trucks, 1 snow plow.	.....	.....
Wisconsin Rapids	..	..	..	50 hand brooms, 1 h.d. mach. broom, 1 pickup & gutter sweeper. 1 can carrier, 2 h.d. sprink. wagons, 3 dirt wagons.	.....	Motor pickup sweeper very satisfactory
Wyoming:						
Cheyenne	40 bus. blks.	..	..	1 h.d. sprink wagon, 2 dirt wagons, 2 dirt carts, 1 snow plow.	.....	.....

REFUSE COLLECTION

City	Population served	Area served, square miles	Classification of refuse collected.	Equipment used for each class.
Alabama:				
Fairfield	5,700	2.5	Garbage.	3 mule-drawn wagons.
Mobile	70,000	25	Combined g., a. and r.	14 carts, 3 wagons, 1 motor truck
Selma	16,000	...	Garbage.	Cars.
Talladega	8,000	7.5	Garbage and refuse.	12 h. d. wagons, 1 Ford truck.
Arizona:				
Clifton	4,000	2	Combined.	2 Ford trucks.
Miami	7,000	1.1	Combined.	.....
Tucson	20,000	6	Combined.	.....
Arkansas:				
Helena	9,000	...	Combined.	.....
Pine Bluff	20,000	0.5	Trash.	Truck.
California:				
Alameda	30,000	...	"Wet garbage," "dry garbage,"	.....
Glendale	15,000	...	Garbage, ashes, rubbish.	.....
Long Beach	60,000	...	Garbage, rubbish.	Garbage—2 Fordson tractors, 10 Lee trailers, 6 h. d. wagons.
Marysville	7,000	2.5	Combined g., a., r.	.....
Monrovia	7,500	4	Garbage, cans.	Garbage, h. d. wagon; cans, motor truck.
Napa	7,000	...	Combined g., a., r.	.....
Oakland	220,000	...	Combined g., a., r.	.....
Ontario	5,000	2	Garbage, ashes, rubbish.	1 truck, 1 wagon.
Pitaluma	6,700	1.5	Garbage, rubbish.	2 dump wagons.
Richmond	18,000	...	Garbage, rubbish.	.....
Sacramento	70,000	...	.....	.....
San Bernardino	20,000	8	Garbage, rubbish.	.....
San Gabriel	3,000	3	Rubbish.	Auto truck.
Santa Ana	25,000	10	Paper; boxes and cans.	Two 2½-ton trucks.
Santa Barbara	25,000	13	Individual arrangements.	.....
So. Pasadena	10,000	2.5	Garbage, rubbish.	1 garbage truck, 1 rubbish wagon.
Colorado:				
Denver	267,000	56	Garbage, ashes, rubbish.	Horse and motor garbage wagons, ash wagons, large rubbish wagons.
Fort Collins	9,000	40	Garbage, ashes, paper	Motor wagon for paper.
Greeley	11,000	1	Garbage, ashes, rubbish.	H. D. wagons
Salida	.....	...	Garbage,rubbish (incl. ashes).	.....
Connecticut:				
Bridgeport	.....	...	Garbage, ashes.	Packard trucks and Lee trailers for both.
Bristol	14,000	1.5	Garbage, ashes.	Garbage, tank wagon. Ashes, wagon.
Hartford	140,000	17.5	Garbage; a. and r. combined.	Rubbish, 4½-yd. bottom dump wagons
Middletown	14,000	3	All combined.	Four 2-horse rear dump wagons.
New Britain	60,000	13	Garbage, other refuse.	.....
New Haven	165,060	...	Garbage.	.....
New London	25,000	5.8	Garbage, other refuse.	.....
Willimantic	12,000	46	Garbage.	.....
District of Columbia:				
Washington	425,000	45	Garbage, ashes, rubbish.	Garbage, 5 trucks, 85 wagons; ashes, 80 wagons, 3 trucks; rubbish, 26 wagons, 2 trucks.
Florida:				
Clearwater	.....	...	Garbage, rubbish.	Light truck.
Fort Myers	45,000	.75	Garbage, rubbish.	2 trucks.
Gainesville	6,000	...	Garbage, rubbish.	H. D. wagons.
Jacksonville	95,000	...	Garbage, rubbish.	Trucks and mule teams.
Sanford	6,000	4	Garbage.	.....
Georgia:				
Albany	16,000	4	Garbage, ashes, rubbish.	5 garbage carts, 1 garbage wagon, 1 ash wagon, 1 ash cart, 1 rubbish cart, 1 rubbish wagon.
Griffin	9,000	...	Garbage, refuse.	.....
La Grange	12,000	4	Combined.	.....
Rome	15,000	3	Combined.	.....
Idaho:				
Boise City	22,000	...	Garbage, refuse.	.....
Pocatello	16,000	2.4	Garbage, ashes, rubbish and ashes.	Garbage, 1 wagon; ashes, 1 wagon; rubbish, 4 wagons.
Illinois:				
Blue Island	15,000	2	Garbage, ashes, rubbish.	Dump wagons.
Chicago	2,800,000	200	Garbage, other refuse.	136 garbage wagons, 3 tractors, 82 ash trailers, 635 ash wagons.
Chicago Heights	20,000	...	Garbage, other refuse.	Teams and trucks.
Evanston	38,000	...	Garbage, other refuse.	Garbage, six 1-horse wagons, 1 Ford truck.
Galesburg	27,696	9	Garbage; tin cans	4 garbage wagons.
Glencoe	.....	...	Garbage, other refuse.	Garbage, truck.
Kewanee	17,000	...	Garbage, rubbish.	.....
Murphysboro	11,000	...	Garbage.	Garbage, tank wagon.
Oak Park	40,000	4.5	Garbage, ashes, rubbish, tree trimmings.	9 garbage wagons, 2 ash trucks 2 ash wagons, 3 rubbish wagons.
Indiana:				
Bedford	1,000	2	Garbage.	1 garbage wagon.
Columbus	10,000	4	Garbage, other refuse.	1 garbage wagon, 4 h. d. rubbish wagons.
Lafayette	23,000	...	Garbage, cans	4 covered wagons.
Mishawaka	17,000	8	Garbage, other refuse.	Two 4-yard h. d. box wagons.
Peru	13,100	20	Garbage, cans.	2 garbage wagons.
Portland	6,000	...	Garbage, ashes.	.....
Richmond	27,000	4	Garbage, other refuse.	6 garbage wagons.
Shelbyville	11,000	31 lin. mi.	Garbage.	Garbage wagons.
South Bend	72,000	...	Garbage.	6 garbage wagons.
Terre Haute	68,000	...	Garbage.	.....
Valparaiso	7,000	...	.....	1 garbage wagon, 1 rubbish wagon.
Wabash	10,000	...	Garbage, ashes, rubbish.	2 garbage wagons, 1 ash wagon, 2 rubbish carts.
West Lafayette	3,500	...	Garbage, rubbish	.....

REFUSE COLLECTION—Continued

City	Population served	Area served, square miles	Classification of refuse collected.	Equipment used for each class.
Iowa:				
Cedar Rapids	47,000	13.2	Garbage	Truck and horse trailers.
Creston	8,500	...	Ashes.	.....
Dubuque	40,000	...	Garbage, ashes.	.....
Mason City	20,000	20	Garbage.	Water-tight wagons.
Muscatine	17,000	...	Garbage.	.....
Red Oak	6,000	...	Garbage.	.....
Kansas:				
Independence	12,000	...	Garbage.	Zinc lined wagons.
Salina	10,000	2.5	Garbage, other refuse.	4 garbage wagons, 10 rubbish carts, 4 rubbish wagons.
Kentucky:				
Fort Thomas	6,500	12	Garbage, other refuse.	Garbage, can-carrying wagon; rubbish wagons.
Louisiana:				
Lake Charles	14,000	...	Tin cans.	.....
New Orleans	390,000	...	Combined.	Tractors and trailers.
Maine:				
Oldtown	5,000	0.8	Combined.	1 rubbish cart.
Maryland:				
Hagerstown	28,000	3	Garbage, cans.	.....
Massachusetts:				
Adams	15,000	4	Garbage.	1 garbage cart.
Beverly	23,000	...	Garbage, other refuse.	.....
Brockton	68,000	...	Garbage, other refuse.	Garbage, 1 truck, 16 1-horse wagons; rubbish, 1 truck, 4 2-horse and 4 1-horse wagons.
Cambridge	110,000	...	Garbage.	H. d. tight wooden carts.
Fall River	122,000	...	Garbage, other refuse.	H. d. tight wagons.
Fitchburg	42,000	...	Garbage, other refuse.	.....
Haverhill	40,000	100 lin. mi.	Garbage, ashes, rubbish.	10 ash carts; garbage, contract.
Holyoke	62,000	23	Garbage, other refuse.	24 rubbish wagons, 1-horse; garbage, 6 2-horse.
Ludlow	1,600	9	Garbage, ashes, rubbish.	Garbage wagon, dump cart.
Lynn	100,000	...	Garbage, other refuse.	.....
Malden	50,000	...	Garbage, ashes, paper.	2 garbage carts, 7 garbage wagons, 2 ash motor trucks, 12 carts.
Medford	40,000	...	Garbage, rubbish, paper.	6 garbage carts, 3 ash trucks, 2 ash wagons, 4 ash carts, 2 rubbish carts.
Middleboro	5,000	72	Garbage, rubbish.	.....
New Bedford	122,000	...	Garbage, rubbish, ashes.	.....
Newburyport	16,000	2	Garbage, other refuse.	.....
North Adams	22,282	...	Garbage.	.....
Newton	47,000	18	Garbage, ashes, rubbish.	Garbage, contract—4 ash wagons, 10 ash carts, 3 rubbish carts.
No. Andover	7,000	...	Garbage, ashes.	.....
Orange	6,000	...	Rubbish.	1 cart.
Peabody	20,000	...	Garbage, ashes, rubbish.	.....
Rockland	2,500	...	Combined.	1 cart.
Waltham	31,000	...	Garbage, other refuse.	Garbage, 5 single and 1 double team; rubbish, truck and teams.
Watertown	22,000	4.3	Garbage, ashes, paper.	2 garbage carts, 2 garbage wagons, 10 ash wagons, 10 ash carts, 2 rubbish carts.
Winchester	9,000	7	Garbage.	2 garbage wagons.
Worcester	180,000	...	Garbage.	22 2-horse teams, 2 trucks.
Michigan:				
Alma	7,500	6	Garbage, ashes, rubbish.	Ashes and rubbish, dump wagons.
Ann Arbor	35,000	2	Garbage.	Private wagons.
Detroit	1,200,000	80	Garbage, other refuse.	Garbage wagons and trucks; rubbish, 337 wagons, 38 trucks.
Flint	110,000	30	Garbage, ashes and rubbish, cans and crockery.	Garbage—12 1-ton and 4 2-ton motor trucks, 6 tractors and 5 10-ton trailers; ashes and rubbish, motor trucks and wagons.
Highland Park	48,000	4	Garbage, rubbish	5 garbage motor trucks, 7 ash trucks, 3 rubbish trucks.
Holland	8,000	1	Garbage, ashes, rubbish.	Private equipment.
Ishpeming	12,000	9	Garbage, ashes.	Garbage—1 wagon, 1 cart; ashes—1 motor truck, 1 wagon; rubbish—6 carts, 1 wagon.
Jackson	35,000	9	Garbage, ashes.	Garbage—8 tank wagons.
Kalamazoo	20,000	3	Combined.	Contract.
Lansing	60,000	48	Garbage, ashes, rubbish.	Garbage—8 motor trucks; rubbish—6 carts.
Ludington	10,000	1.5	Garbage, tin cans.	.....
Monroe	5,000	1	Combined.	Garbage—1 cart, 1 wagon; ashes—2 trucks, 1 wagon.
Muskegon	4,100	...	Combined.	4 1-ton trucks, 3 carts, 4 wagons.
Owosso	14,000	...	Garbage.	.....
Pontiac	35,000	7	Garbage, ashes, rubbish.	Garbage—trucks and trailers; rubbish—trucks.
Sturgis	7,000	1.5	Garbage.	1 wagon with trailer.
Minnesota:				
Austin	2,000	2.8	Combined.	1 garbage wagon.
Ely	5,000	...	Garbage, other refuse.	1 water-tight wagon.
Minneapolis	385,000	...	Garbage.	.....
Rochester	15,000	6	Garbage	3 wagons, 2 motor trucks.
St. Paul	240,000	54	Garbage	40 garbage wagons.
Mississippi:				
Hattiesburg	.....	...	Garbage, rubbish.	.....
Natchez	.....	...	Combined.	8 carts.
Vicksburg	15,000	3	Combined.	7 carts, 2 wagons.
Missouri:				
Columbia	.....	0.1	Combined	.....
Joplin	.....	...	Garbage.	.....
Sedalia	22,000	...	Combined.	Dump wagons.
Montana:				
Havre	.....	...	Combined.	.....
Kalispell	6,000	3	Combined.	1 wagon, 2 rubbish carts.

REFUSE COLLECTION—Continued

City	Population served	Area served, square miles	Classification of refuse collected.	Equipment used for each class.
Nebraska:				
Hastings	300	...	Garbage.	...
Lincoln	...	...	Combined.	...
Omaha	...	...	Garbage.	...
New Hampshire:				
Dover	...	...	Garbage, ashes, rubbish.	...
Franklin	6,500	20	Ashes, other refuse.	1 cart, 1 wagon, 1 motor truck
Laconia	...	...	Ashes, rubbish.	...
Nashua	29,000	...	Garbage, ashes, combustible.	3 motor trucks, 4 ash wagons, 1 rubbish cart.
New Jersey:				
Asbury Park	75,000	1	Garbage, ashes, rubbish.	Contract.
Atlantic City	...	7	Garbage, other refuse.	Refuse—16 wagons.
Freehold	5,000	¾ sq. mi.	Garbage.	...
Hackensack	18,000	4	Combined.	6 bottom-dump wagons.
Montclair	31,000	3.940 acres	Garbage, ashes and rubbish.	4 2½-ton Packard (garbage) trucks, rubbish, 5 carts (7 cu. yd.). Ashes, 10 3½ cu. yd. teams.
Newark	41,524	20 sq. mi.	Garbage, ashes and rubbish.	...
Phillipsburg	17,000	3	Garbage, ashes.	Contract.
Roselle Park	6,000	2 sq. mi.	Garbage and ashes.	...
Westfield	6,000	1,000 homes	Combined.	...
New York:				
Amsterdam	36,000	6½ sq. mi.	Garbage and rubbish.	...
Auburn	36,500	...	...	3 motor trucks, 1 garbage wagon.
Buffalo	600,000	42	Garbage, ashes and rubbish.	21 tractors, 50 garbage trailers, 165 ash wagons, 42 rubbish wagons.
Hempstead	7,500	25 mi.	Garbage, tin cans, bottles, ashes.	2 Ford trucks.
Johnson City	10,000	1 sq. mi.	...	...
Kingston	30,000	7	Garbage, ashes.	7 1-horse ash wagons, 5 2-horse garbage.
Niagara Falls	60,000	...	Garbage, ashes, rubbish.	Motor trucks and horse drawn vehicles.
Ossining	12,000	6 sq. mi.	Garbage, rubbish.	2 garbage wagons, 3 ash wagons.
Rockville Center	9,000	4 sq. mi.	Household mat. only.	Horse-drawn vehicles.
Saratoga	13,000	30	Garbage, ashes.	Private.
Tarrytown	6,000	...	No separation.	...
Utica	100,000	18 sq. mi.	Garbage, ashes.	...
Watervliet	17,000	2 sq. mi.	No separation.	...
North Carolina:				
Durham	30,000	3.9 sq. mi.	...	4 ash carts, 3 rubbish trucks, 3 garbage carts, 9 garbage wagons.
Elizabeth City	10,000	25 mi.	Garbage, rubbish.	1 garbage truck, 4 rubbish carts.
Fayetteville	10,000	2 sq. mi.	...	Wagons, carts and trucks.
Goldsboro	...	...	Garbage, ashes, rubbish.	6 horse carts.
Greensboro	21,225	4	Ashes, all other refuse.	Garbage—2 carts, 4 wagons, 6 trucks. Ashes—4 wagons; rubbish—6 carts, 4 wagons.
Henderson	8,000	1 mi. from cen.	Garbage, ashes, rubbish.	...
Wilmington	40,000	...	Garbage, rubbish.	3 garbage carts, 2 rubbish trucks, 5 rubbish carts, 1 ash truck. 3 auto trucks.
North Dakota:				
Jamestown	...	...	...	...
Ohio:				
Akron	165,000	25 sq. mi.	Garbage only.	2 garbage wagons, 6 rubbish trucks,
Ashtabula	10,000	10 mi.	Garbage, rubbish.	4 rubbish wagons.
Bellefontaine	10,000	4 sq. mi.	...	...
Bucyrus	900	...	Garbage.	2 h. d. wagons, 1 tractor.
Chillicothe	16,000	12 mi.	...	...
Cincinnati	401,247	71 sq. mi.	Garbage, ashes, rubbish.	15 dirt wagons, 100 ash wagons, 6 ash carts.
Circleville	7,000	25 mi.	General.	...
Dayton	152,000	16 sq. mi.	Garbage, ashes and rubbish.	16 wagons.
Fremont	14,153	2 sq. mi.	Rubbish.	...
Portsmouth	40,000	10.81 sq. mi.	Garbage, ashes and rubbish.	10 garbage wagons.
Urbana	8,600	3½ sq. mi.	Garbage.	...
Oklahoma:				
Ada	8,000	2 sq. mi.	Garbage, cans, bones and sticks.	Wagons.
Enid	10,000	8 mi.	Garbage, ashes and rubbish.	6 h. d. wagons.
Oregon:				
La Grande	7,000	3½ sq. mi.	Garbage, rubbish.	...
Pennsylvania:				
Ashland	7,000	...	Ashes.	...
Beaver Falls	15,000	2	Garbage wrapped in paper.	1 cart, 1 wagon.
Carlisle	15,000	1,400 acres	Garbage contr., a. & r. private.	...
Dormont	8,500	1 sq. mi.	Garbage.	...
Easton	34,000	3.3	Combustible, incombustible.	1 truck, 5 wagons.
Freeland	...	½ sq. mi.	Private by individual.	Closed wagons.
Greenville	8,500	...	Garbage, all other refuse.	Sideboard wagons.
Kittaning	8,000	6 mi.	Garbage.	1 garbage wagon.
Lewistown	10,000	2 sq. mi.	Garbage and ashes.	Horses and wagons.
Meadville	15,000	1,351 acres	Garbage, rubbish.	...
No. Braddock	10,000	900 acres	Garbage, rubbish.	...
Pittston	10,000	4	Garbage, all other refuse.	1 garbage truck, 1 dump wagon.
Rankin	7,500	275 acres	Garbage, ashes, tin cans.	...
Summit Hill	Ap. 6,000	7 mi.	Ashes, garbage.	...
Williamsport	...	...	Waste.	1 Elgin motor sweeper.
Rhode Island:				
Newport	32,589	...	Refuse.	5 carts.
Westerly	160,000	2 sq. mi.	Street sweepings.	...
South Carolina:				
Chester	6,000	...	Rubbish.	Street flusher, brooms, push carts.
Spartanburg	25,000	3 mi.	All inflammable material.	...
Tennessee:				
Memphis	163,000	25 3/10 mi.	Garbage, ashes and rubbish.	8 trucks, 76 carts.
Morristown	7,000	3 sq. mi.	No classification.	Same as for street cleaning.
Texas:				
Beaumont	50,000	10 sq. mi.	No classification.	...
Dallas	175,000	25 sq. mi.	No classification.	...
Navasota	5,000	2 sq. mi.	No classification.	...

REFUSE COLLECTION—Continued

City	Population served	Area served,	Classification of refuse collected.	Equipment used for each class.
Utah:				
Brigham	Bus.	½ mi.	Ashes and cans.	.....
Vermont:				
Bennington	.....	18 mi.	Cans.	.....
Burlington	22,000	2 sq. mi.	Garbage.	4 H. D. water-eight garbage wagons.
Virginia				
Bristol	8,000	3 sq. mi.	Rubbish.	.....
Danville	.....	4½ sq. mi.	No separation.	.....
Lynchburg	3,500	4 sq. mi.	Garbage, ashes.	7 garbage wagons, 4 Troy ash wagons.
Newport News	35,000	4.55 sq. mi.	No separation.	.....
Petersburg	33,000	6 sq. mi.	Ashes and trash.	H. D. dump wagons.
Roanoke	60,000	9½ sq. mi.	Ashes, garbage and rubbish.	3 1½-cu. yd. wagons, 2 4-cu. yd. garbage trucks, 5 4-cu. yd. ash wagons.
Washington:				
Walla Walla	15,503	3.8 sq. mi.	Garbage, rubbish.	.....
West Virginia:				
Clarksburg	30,000	5 sq. mi.	Dry and wet refuse.	2 trucks.
Huntington	60,000	...	No separation.	.....
Wisconsin:				
Ashland	11,500	...	.....	.....
Menasha	1,800	3 sq. mi.	No separation.	.....
Green Bay	.....	...	Garbage, ashes.	Ford dump body truck, 6 teams.
Racine	75,000	8 sq. mi.	Garbage, ashes, rubbish.	Truck and trailer.
Sheboygan	31,000	3,000 acres	Garbage, ashes, rubbish.	Truck.
Wisconsin Rapids	7,000	7 sq. mi.	Combined.	Garbage wagons.
Wyoming:				
Cheyenne	14,000	1 sq. mi.	No separation.	.....

(*Continued from page 271*)

first, that in which he furnishes his own garbage can and collections are made by wagons or trucks at least twice weekly or in most cases more frequently; or, second, by paying a fee of $5.00 yearly for one can and $3.00 for each additional can he secures a service by which all cans are furnished by the city and collections are made every second day, a clean, sterilized can being left and the full one removed. The costs of the first service are borne entirely by a special tax. The general collections are made with one-horse wagons and one Ford truck. The special collections are made by two trucks equipped with special bodies for carrying the cans. Complete records of cost are not available, but those at hand indicate that garbage was collected and disposed of last year (being burned in a municipal incinerator) at a cost of about $2.50 per yard, the average haul being about 2½ miles.

About 50 per cent of the ashes are dumped on the ground, either near or in the alley, by the householder and shovelled into the wagons by the collectors. The ashes are used largely for grading and surfacing unimproved streets.

BROCKTON, MASSACHUSETTS

In Brockton, Massachusetts, rubbish and ashes are collected by the Health Department, the barrels being placed at the street-line. However, the Department will remove the material from the cellar at $1.50 per load of about ten barrels, or for $1.00 a load from the yard. Collections are made by one truck, four double teams and four single teams. The appropriations and revenues for the past five years have been as follows:

	Appropriations	Revenues
1917	$20,790	$2,700
1918	22,773	2,522
1919	30,960	3,618
1920	41,101	6,588
1921	37,664	6,349

The rates of collection were doubled in 1920, which accounts for the sudden jump.

WALTHAM, MASSACHUSETTS

In Waltham, Massachusetts, the city, prior to April, 1922, had its garbage collected by contract, but at that date began collecting by municipal labor and hauling to a central location, where it is sold to farmers. City Engineer Beal gives it as his opinion that "the contract method of garbage collection in a city the size of Waltham is unsatisfactory at best. We have tried this method for the past five years and the results have given general dissatisfaction. For two years the public has clamored for the return to collection by the city, which was in vogue for years previous to 1917 and gave general satisfaction, although far more expensive than the contract method."

ALMA, MICHIGAN

Alma, Michigan, has contracted for garbage collection with the owner of a hog farm, the payment being on the rather unusual basis of 3 cents for each collection of garbage, the garbage being removed twice a week from the residence section and daily in the business section. City Manager Reynolds reports that the service received has been very good and quite satisfactory.

OWOSSO, MICHIGAN

In Owosso, Michigan, a city of about 14,000, the garbage is collected by a private concern under city ordinance, the collector using the garbage for hog feed. An unusual feature is that the collector furnishes the garbage cans. He collects every other day and the householder pays $1.00 per month for the service.

AUSTIN, MINNESOTA

In Austin, Minnesota, the combined refuse is collected by a private contractor who is paid, partly by the city and partly by the householder, $1,620 per year. From 300 to 500 householders pay 50 cents per month for each residence and $1.50 for a business house, and the city makes up the deficit, which ordinarily runs from $700 to $1,000 per year.

(*To be continued*)

Some Refuse Incinerators

Operating details of twenty incinerators as reported from an investigation by the city manager of Alameda, California.

Some months ago the city manager of Alameda, California, Clifton E. Hickok, was requested by the city council of that city to inspect the refuse incinerators in the western and middle western parts of the country, and visited twenty incinerators in California, Oregon, Washington, Vancouver, Minnesota, Missouri, Oklahoma, Texas and Louisiana. The information thus obtained was presented by him in a paper before the League of California Municipalities from which the following information has been derived, that part being tabulated which could readily be treated in this way.

This table shows that nine of the incinerators visited were of the English type, four of the Decarie type and seven of the Dutch oven type. Those lying outside of California were visited in October and November of last year, and the information given is brought up to that date only.

Based on information obtained by this visit and otherwise, Mr. Hickok makes some general remarks on incinerator practice, with special reference to the adoption of incineration for the city of Alameda. This city has a population of 30,000, which is very largely residential, and produces practically no industrial, trade or stable wastes. From observation and measurements he estimated that there was produced on the average 5 tons of garbage and 22 tons of rubbish per day, 19 tons of the rubbish being combustible and three tons non-combustible. Of these 27 tons of refuse, 25 tons was reaching the dumps between 10:00 a. m. and noon, and the other two tons between 4 p. m. and 5 p. m.

He gives as the major elements entering into the success of an incinerator: 1. First cost. 2. Operating cost. 3. Successful burning capacity. 4. Receiving capacity. 5. Maintained temperature of at least 1250 degrees F. 6. Simplicity of operation as regards charging, stoking and removal of clinkers and ash. 7. Comparative freedom from obnoxious odors and smoke. 8. Minimum fuel requirements. 9. Absence of complicated mechanical contrivances.

He divides incinerators into three types — the English type, the steel furnace or water-jacket type and the Dutch oven type.

The tabulated data obtained on his inspection shows the cost of construction varying from approximately $200 per ton per day capacity to $1,500. The cost per ton for burning refuse varies almost as widely—from 47¼c. per ton burned to $3.19. In a number of instances the high cost of burning was found to be accountable for by local conditions. The $3.19 in New Orleans, which was paid almost entirely for labor, was unnecessarily high because a needless number of men were employed and also because the plant was too elaborate mechanically. The plant showing the lowest cost was one of the two largest in the list. Another plant of the same make and two-thirds the capacity was costing nearly five times as much per ton, but here again the staff was unnecessarily large.

No fuel was used in any of the English type of furnace, and one of the Dutch oven type also was operated without fuel, but all of the others required more or less additional fuel, oil being used in a number of the California plants.

A number of the plants were located where any nuisance given off would be seriously objectionable. For instance, in Pasadena the plant is located in the heart of the city on a prominent boulevard, with industries and residences on all sides and with one of the state's noted hotels within 1500 feet, but it is said that no complaints have been received. The New Orleans plant is located on a street in a modest residence district, with houses within 100 feet of it. That at Beaumont, Texas, is located within two blocks of the main business district and immediately adjacent to a police station, and there are homes of white people directly across the street and factories and warehouses close by.

Boilers are reported as being installed in connection with four of the plants, two of these being plants of the English type and two of the Decarie type. Mr. Hickok reports that the boiler in Berkeley, California, "has not justified its installation." In Portland, Oregon, there are two 100-H. P. boilers "for the operation of fans, for heating and hot water," but apparently for nothing else. The boiler at Santa Cruz "proved unsuccessful and its use was abandoned." In Minneapolis a 330-H. P. boiler was located between two furnaces, and is also fired independently. The steam is used to operate three generating units in an adjoining engine room, the current from which is utilized for street-lighting, etc. The amount of steam that is generated by the burning of the garbage is negligible. Apparently none of the other plants made any effort to utilize the heat for raising steam, except in Sacramento, where the steam from the Decarie plant is used for providing forced draft.

As to the satisfactoriness, most of them seem to have met his requirements in this respect. Exceptions noted were the old Thackeray furnace in San Francisco, where he found much unconsumed material in the clinker, and the same condition at New Orleans and Vallejo; a considerable quantity of smoke from the plants at Minneapolis and Baton Rouge, and considerable odor at the latter city and at Vallejo. Each of these two last named were reported, however, to be operated carelessly.

Incidental to the incinerator, it was learned that certain other plans had been tried in a few of the cities. For instance, Pasadena had tried grinding a part of the garbage for chicken feed, but this had proved unsuccessful. At the Thackeray furnace in San Francisco there had been a foundry for making sash weights from tin cans and other metals, but this also had not been a success.

He includes in his list the plant built for San Francisco in 1913, which the city refused to accept and which has never been used, and the plant built in Seattle in 1907, but which went out of commission in 1915, and the metal parts were sold during the war, when metal prices were high.

OPERATING DETAILS OF INCINERATORS AS GIVEN BY CITY MANAGER OF ALAMEDA

City	Make of Plant	Year Built	Cost	Rated Capacity	Amount Actually Burned	Number of Operators	Cost per Day for Labor	Cost per Day for Fuel	Average Cost per ton Burned	Boiler	Remarks
English Type											
San Jose, Cal..	Fred P. Smith	1913	$30,000	3 1/3 T. per hr.	12 T. in 8 hr.	2	$9.00	None	$0.75		Oil burner installed, but not necessary. No material odor or smoke.
Pasadena, Cal...	Fred P. Smith	1912	42,251	83 T. per hr.	5 T. per day§	1 1/2	7.65	None	1.53		Grinding part of garbage for chicken feed unsuccessful. In heart of city on boulevard. No complaints. Garbage fed to hogs.
Portland, Ore...	Fred P. Smith	1911	99,900	6 1/4 T. per hr.	157 T. per day	18	69.00	No fuel	.47¼	Two 100 h.p.	No separation of material except ashes and cans.
Vancouver, B. C.	Fred P. Smith	1911	67,491	4 1/6 T. per hr.	16 T. in 8 hr.	6	31.30	None	2.17		Staff unnecessarily large.
Vancouver, B. C.	Heenan-Froude	1907			Closed 1916		Excessive				
Berkeley, Cal...	Sterling destructor	1913	65,000	2 T. per hr.	37 1/2 T. in 16 hr.	7	40.00	None	1.07 (labor only)	Water tube	Mechanical charging and clinker removing. Forced draft. Constant stoking. Boiler "has not justified installation."
San Francisco...	Thackeray	1897	400,000†	25 T. per hr.	400 T. per day	51		No fuel	1.00		Badly deteriorated. Sash weight foundry for utilizing tin cans, etc., a failure.
San Francisco ..	Heenan-Froude	1913	155,000	5 T. per hr.	Not operated						City refused to accept claimed specifications as to odor, smoke and dust not met.
Seattle, Wash...	Meldrum	1907		Not operated since 1915.							Sold for old metal during war.
Steel Furnace											
Sacramento, Cal.	Decarie	1907	62,000	3 1/3 T. per hr.	66 T. in 16 hr.	8	47.16	$1.08	.52		Steam used for forced draught.
Santa Cruz, Cal.	Briggs (similar to Decarie)	1915	7,000	1 1/4 T. per hr.	3/4 T. per hr.	1	4.50	3.50	1.33	Unsuccessful; not used	Oil and shavings for fuel. Mixed refuse.
Minneapolis, Minn.	Decarie	1901		6 2/3 T. per hr.	56.3 T. per day	15	79.00	13.00	1.63	One 330 h.p	Steam from incinerator negligible.
New Orleans, La.	Decarie	1916	35,000	1 1/2 T. per hr.	8 T. in 8 hr.	6	25.20	.24	3.19		Houses within 100 ft.; little complaint. Too elaborate mechanically.
Dutch Oven											
Vallejo, Cal....	Collins & Pellet	1919	12,000	1.5 T per hr.	25 T. in 24 hr.	4	20.00	1.40	.85		Oil burner. Very short stack. Carelessly operated; considerable odor.
Presidio, S. F...	Lea and Nye	1914	4,000*	2/3 T. per hr.	2 T. in 8 hr.	1	....	....	2.56		Oil burner. Very short stack. Nothing but garbage burned.
Sedalia, Mo.....	Nye Odorless	1921	15,000	1 T. per hr.	10T. per day	1	3.84	2.35	.62		Destroyed more than a horse a day.
Tulsa, Okla.....	Nye Odorless	1921	25,000*	4 T. per hr.	? Just built						
Waxahachie, Texas	Nye Odorless	1921	8,000	1/2 T. per hr.	4 T. in 8 hr.	1	2.32	.08	.60		No separation of garbage and refuse.
Beaumont, Tex..	Nye Odorless	1921	10,000	1 T. per hr.	14 T. in 8 hr.	3	7.20	.69	56		Adjoins police station.
Baton Rouge, La.	Nye Odorless	1914		1 T. per hr.	6 T. in 8 hr.	2	4.00	None	.67		Plants (2) neglected; smoke and odor.

*Furnace alone. †Paid by city in 1909. §Rubbish only.

NEWS OF THE SOCIETIES

CALENDAR

Dec. 26-30—AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Meeting, Massachusetts Institute of Technology, Cambridge, Mass.

Jan. 9—NEW ENGLAND WATER WORKS ASSOCIATION. Annual meeting, Boston, Mass. Secretary, Frank J. Gifford, Tremont Temple, Boston.

Jan. 11-12—AMERICAN ENGINEERING COUNCIL. Annual meeting at new headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. Secretary, L. W. Wallace, 24 Jackson Place, Washington, D. C.

Jan. 11-12 — FEDERATED AMERICAN ENGINEERING SOCIETIES. Annual meeting, Washington, D. C.

Jan. 15-17—NATIONAL CRUSHED STONE ASSOCIATION. Annual convention at Chicago. Secretary, A. P. Sandles.

Jan. 15-18 — AMERICAN ROAD BUILDERS ASSOCIATION. Annual convention, Chicago.

Jan. 17-18—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, 29 West 39th Street, New York City. Secretary, John H. Dunlap.

Jan. 22-26—AMERICAN CONCRETE INSTITUTE. Annual convention, Cincinnati.

Jan. 23-25—ILLINOIS SOCIETY OF ENGINEERS. Annual meeting at Peoria. Secretary, E. E. R. Tratman, Wheaton, Ill.

Jan. 23-26—IOWA ENGINEERING SOCIETY. Annual Meeting in Des Moines. Secretary, Lloyd A. Canfield, 406 Flynn Building, Des Moines.

Jan. 24—BOSTON SOCIETY OF CIVIL ENGINEERS. Meeting, Boston, Mass. Secretary, J. B. Babcock, Tremont Temple, Boston.

Jan. 25-26 — SOUTH ATLANTIC COASTAL HIGHWAY ASSOCIATION. Meeting at Charleston, S. C. Secretary, A. V. Snell, Jacksonville, Fla.

Jan. 27—NORTHEASTERN SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, Boston, Mass.

Jan. 30-Feb. 3—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual meeting, Los Angeles, Calif.

May 7-9—AMERICAN ASSOCIATION OF ENGINEERS. Ninth annual convention, Norfolk, Va. Secretary, C. E. Drayer, Chicago.

May 21-25 — AMERICAN WATER WORKS ASSOCIATION. Annual convention, Statler Hotel, Detroit, Mich. Secretary, John M. Diven, 152 West 71st Street, New York City.

Nov. 12-16—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, Memphis, Tenn. Secretary, Charles Carroll Brown, St. Petersburg, Fla.

GOOD ROADS CONGRESS, CONVENTION AND SHOW

The American Road Builders' Association will hold its Thirteenth American Good Roads Congress, Twentieth Annual Convention and Fourteenth National Good Roads Show and Highway Industries Exhibit January 15, 16, 17, 18 and 19, 1923, in Chicago. The Coliseum and adjoining buildings, in which the shows in 1921 and 1922 were held, have been leased again for this purpose. At the drawing for space held November 17, practically every foot of the 50,000 square feet of exhibition space in the Coliseum and Annex was taken.

The next congress and convention will be held at the Congress Hotel, instead of the Coliseum as heretofore. It is believed that this arrangement will insure a better attendance at each session, while the show will continue without interruption. The new arrangement, too, will eliminate the noises that heretofore have been so disturbing to the speakers and delegates.

The old idea of a session on bituminous roads, another on concrete, a third on brick, and so on, has been entirely abandoned, and controversial subjects on which there is much need for light will be featured. Men who are leaders in solving the complex problems confronting the industry will present these subjects; other men of equal experience and standing will lead the discussions. Some of the papers will be printed well in advance and circulated, so as to permit of thorough study in preparation for an exhaustive discussion on the floor.

From the official program here presented in full it will be noted that results of the latest research investigations by the United States Bureau of Public Roads, the State Highway Department of Illinois and other organizations and institutions conducting research work are stressed for detailed discussion. Highway finance and highway transportation will receive in full the serious consideration they merit, as well as the future of Federal aid to the states and other national and state road problems, both in administration, construction and maintenance. No session will be held on Wednesday afternoon, in order that all delegates in attendance may be entirely free to visit the Good Roads Show at the Coliseum. The program for the congress will be as follows:

Official Program

Opening Session

Tuesday, January 16, 10 A. M.

Chairman—Thomas J. Wasser, State Highway Engineer of New Jersey, President, American Road Builders' Association.

President's address.

Greeting and Inspiration—James H. MacDonald, Treasurer, American Road Builders' Association.

Continued Highway Expenditures Required to Meet Traffic Demands of the Future—Thomas H. MacDonald, Chief, United States Bureau of Public Roads, Washington, D. C.

Progressive Construction of Highways—(a) Practice in North Carolina, C. M. Upham, State Highway Engineer, North Carolina; (b) Practice in Iowa, C. Coykendall, Assistant Chief Engineer, Iowa Highway Commission.

The Obligation of the State Highway Department to Keep the Public "Sold" on Highways—By H. E. Hilts, Acting Chief Engineer, Pennsylvania State Highway Department, Harrisburg, Pa.

Design

Tuesday, January 16, 2:30 P. M.

Chairman—Thomas H. MacDonald, Chief, United States Bureau Public Roads.

What Test Road Results Have Taught Us—(a) Bates Test Road, Clifford Older, State Highway Engineer of Illinois, Springfield, Ill.; (b) Pittsburgh Test Road, Lloyd Aldrich, Consulting Engineer, San Francisco, Cal.; (c) Arlington Tests, A. T. Goldbeck, Engineer of Tests, United States Bureau of Public Roads, Washington, D. C.

Development of Appartus for Field ing Engineer, Division of Highways, Testing of Roads—H. F. Clemmer, Test-Springfield, Ill.

Developments in the Use of Local Materials—Vernon M. Pierce, District Engineer, United States Bureau of Public Roads, Washington, D. C.

Designed Subgrade—C. M. Upham, State Highway Engineer, Raleigh, N. C.

Construction

Wednesday, January 17, 10 A. M.

Chairman—J. H. Cranford, President, Cranford Paving Company, Washington, D. C.

Haulage Methods in Highway Construction—Industrial Railways, A. J. Parrish, General Contractor, Paris, Ill.; Heavy Truck Haulage, Charles H. Fry, Charles H. Fry Construction Co., Erie, Pa.; Light Truck Haulage, A. E. Horst, Henry W. Horst Co., Rock Island, Ill.

How to Equip and Operate Local Gravel Pit to Produce Concrete Aggregate—H. E. Kuelling, Construction Engineer, Wisconsin Highway Commission, Madison, Wis.

How Much Time Is Lost in Delays in Highway Building?—H. K. Davis, Chief Inspector, Iowa Highway Commission, Ames, Iowa; Discussion, B. H. Piepmeier, State Highway Engineer of Missouri, Jefferson City, Mo.

What Road Building Work Can Be Done in Winter?—John H. Mullen, Chief Engineer, Minnesota Highway Department, St. Paul, Minn.

Maintenance

Thursday, January 18, 10 A. M.

Chairman—A. R. Hirst, State Highway Engineer, Madison, Wis.

Organization of Intensive Maintenance on a State Highway System in Eighteen Months—Frank Page, Chairman, North Carolina State Highway Commission, Raleigh, N. C.

Four Years' Experience with Patrol Maintenance in Wisconsin—J. T. Donaghey, Maintenance Engineer, Wisconsin Highway Commission, Madison, Wis.

Gravel Road Maintenance Practice in Michigan—L. H. Nielsen, Deputy State Highway Commissioner of Michigan, Lansing, Mich.

Blade Grader and Road Drag Earth-Road Maintenance in Iowa—W. H. Root, Maintenance Engineer, Iowa State Highway Commission, Ames, Iowa.

Salvage and Maintenance of Macadam Roads—W. A. Van Duzer, Assistant Maintenance Engineer, Pennsylvania Highway Commission, Harrisburg, Pa.; Discussion, A. W. Muir, Superintendent of Maintenance, New Jersey Highway Commission, Trenton, N. J.

Traffic

Thursday, January 18, 2:30 P. M.

Chairman—Thomas J. Wasser, State Highway Engineer, New Jersey.

Tourist Traffic as a Factor in Highway Development (Illustrated)—A. R. Hirst, State Highway Engineer of Wisconsin, Madison, Wis.

Changes Needed in Motor Vehicle Legislation and License Fees—J. N. Mackall, Commissioner of Roads, Baltimore, Md.; Discussion, Leon C. Herrick, Director of Highways and Public Works, Columbus, O.; Harry Meixell, Jr., New York, National Automobile Chamber of Commerce.

Election of officers.

Business meeting.

Finance and Miscellaneous

Friday, January 19, 10 A. M.

Chairman—Frank Page, Highway Commissioner of North Carolina.

Have Large Expenditures Changed the Public Attitude Toward Highway Development?—S. E. Bradt, former Superintendent of Highways of Illinois.

Co-operation Between State and County Highway Departments—L. C. Herrick, Director of Highways and Public Works, Columbus, Ohio.

How Individual Organizations Can Fit Their Work into the Broad Highway Research Program—W. K. Hatt, Director, Highway Research Committee, National Research Council, Washington, D. C.

THE GOOD ROADS SHOW

The exposition of labor-saving machinery, materials, methods and appliances will open at the Coliseum Monday, January 15, at 8 P. M., and will surpass in the number and variety of its exhibits the great exposition of last year. Many firms which heretofore have never exhibited at the National Good Roads Show have engaged space.

The exhibits will include every kind of practical road building machinery, materials, appliances and transportation equipment. They also will include many new inventions that have been developed during the past year and many improvements in existing lines which will be announced for the first time. Anyone who contemplates purchasing machinery, materials or appliances cannot afford to forego a personal inspection of the exhibits. It is the purpose of the American Road Builders' Association to make this show exceed in educational value all others heretofore. The show will be open at all times to any and every one interested in highway construction and the good roads movement in general.

An interesting feature of the show will be an exhibit by the United States Bureau of Public Roads, for which more than 2,000 square feet of space will be necessary, as well as complete exhibits dealing with road construction by several state highway departments and the Asphalt Association, the Portland Cement Association, the National Association of Paving Brick Manufacturers, the Associated Pennsylvania Highway Contractors and similar organizations that will demonstrate the latest methods evolved in laying the various types of pavements. The exhibit of the United States Bureau of Public Roads will be much more extensive and interesting than the elaborate display which attracted so much attention at the show last year. One of its most attractive features will be a large model showing the type of road the bureau is building in the national forests. The model will be twenty feet in length and will represent a section of highway in a typical mountain region. The road will be hung upon the face of precipitous cliffs high above the valley floor and at one point it will be conducted over a deep gorge by a handsome arch bridge. The beauty of the model will be enhanced by a large painting in oil so as to furnish a gorgeous background and add to the realism of the model. The painting and model will be ten feet high and when seen from a slight distance it will be impossible to detect the junction between them, so cleverly have the artists done their work.

Around the model as a center-piece will be grouped a display of illuminated colored photographs showing Federal aid roads in all parts of the country, together with interesting views of the experimental and research work done by the bureau. Small models of bridges and roads of various types in course of construction will be included in the exhibit, as well as a display of testing apparatus that will include a number of new devices developed by the bureau's engineers.

Progress in Federal aid road construction will be shown graphically by means of numerous charts. A large map will show what has been accomplished in extending the Federal aid highway system. The exhibit will also include a large assortment of specimen road materials, stereopticon lantern slides and motion pictures of actual road construction. The exhibit will be the most complete highway exhibit ever made by any government in the world.

ASSOCIATED GENERAL CONTRACTORS

The Fourth Annual Meeting of the Associated General Contractors of America will be held in Los Angeles January 30 to February 2. It will be devoted to a consideration of progress made in the joint conferences on standard contract forms, relations with state highway officials, construction equipment, and trade practices in the marble industry.

Other subjects discussed will be the work of the National Board of Jurisdictional Awards, the American Construction Council, and legislation affecting immigration and day labor work. Standard estimate sheets and bank statements for general contractors will be presented at the meeting. Special sessions will be devoted to problems of building, highway, railroad and public works contractors. A "Convention Special" will leave Chicago January 24, the day following the close of the Annual Road Show in that city, which will be joined by other groups at Omaha, Denver and Salt Lake City.

SOUTH ATLANTIC COASTAL HIGHWAY ASSOCIATION

This association will meet in Charlestown, S. C., January 25 and 26. The first session will be devoted to general statements in regard to highway and business matters. Thursday afternoon there will be group meetings to complete county organizations. Friday morning reports of state committeemen will be received and in the afternoon reports of general committees and a discussion of ways and means for completing unfinished portions of the road.

AMERICAN CONCRETE PIPE ASSOCIATION

The annual convention of this association will be held at the Sherman Hotel, Chicago, January 18 to 20. The secretary is N. W. Loving, 111 West Washington Street, Chicago.

AMERICAN CONCRETE INSTITUTE

The 1923 Convention of the American Concrete Institute will be held in Cincinnati, at the Hotel Sinton, January 22 to 25. The program includes a session on Monday devoted to "Concrete Products Manufacture" and one on "Concrete Roads"; on Tuesday a second session on "Concrete Products," one on "Field Problems" and one on "Concrete Houses and Architectural Concrete."

AMERICAN SOCIETY OF CIVIL ENGINEERS

The 70th Annual Meeting of this society will be held at the headquarters on January 17, 18 and 19. Annual reports will be read, officers elected, reports of special merit read, medals and prizes awarded, honorary membership conferred, and other business transacted.

NORTH CAROLINA SECTION, AMERICAN WATERWORKS ASSOCIATION

The second annual meeting of the North Carolina Section of the American Water Works Association was held at Gastonia, N. C., November 14-16. A novel feature of the gathering was the holding of the regular meetings on the lower floor of the new two million gallon water filteration plant of the city. This plant was recently completed and is very up to date in its appliances, affording an opportunity for inspection to the many visiting superintendents.

The registration was one hundred and twenty, which was by far the largest attendance ever had at any meeting of water works men in the state. Of those present about 47 were superintendents, filter plant operators, or were otherwise actively engaged in water supply operation. All of the principal consulting engineers of the state engaged in the design of water supplies and purification plants were present, and a goodly number of manufacturers' representatives were engaged in describing the interesting exhibits.

The meetings were all unusually well attended, the papers covering a wide field so that nearly every man present found one or more papers dealing with subjects of especial interest to him.

In addition to inspecting the details of the new filtration plant under the guidance of the superintendent, C. E. Rhyne, those attending the meetings were taken in cars to the new activated sludge sew-

age treatment plant, designed by William Piatt of Durham. This plant makes use of a modification of the Maclachlan process of sludge dewatering by use of sulphur dioxide gas generated at the plant. This modification was devised by William Piatt and is working most satisfactorily, the sludge, after being treated and pressed, appearing as an inoffensive sludge cake, which is used for fertilizer.

C. W. Grantham, city manager of Goldsboro, urged the Section to take some steps toward obtaining a state plumbing code. The secretary, Professor Saville, described briefly the work done by the subcommittee on plumbing of the United States Department of Commerce and the outline for a model plumbing law which it was soon to issue. It was suggested that a committee of the Section be appointed to consider the question of a state plumbing law and report its recommendations to the next annual meeting.

A spirited discussion took place with regard to charges for private fire services. Sherwood Brockwell, deputy state insurance commissioner, presented the insurance side of the case, while city managers Grantham of Goldsboro and Alexander of Gastonia spoke from the point of view of the municipality.

The chief discussions were brought out in connection with papers by J. O. Craig on "Water Rates," by W. McK. Moffitt and J. S. Bennett on "Universal Pipe," by M. N. Boyles on "Experience with Wood Stave Pipe," and by W. D. Cates on "Water Works Superintendent' Responsibility for Fire Fighting." Mr. Cates mentioned that in the recent serious fire in Atlanta, the threads on hydrants had been found so badly worn by use of hydrants for street flushing as to seriously interfere with their use for fire service.

A complimentary banquet was given by the city on the second evening, following a get-together dinner, held on the first evening. The Hill membership cup, which is given annually to that section of the A. W. W. A. having the greatest per cent. increase in membership, was won by the North Carolina Section last year, and was displayed prominently at the dinners. The Section was organized in September, 1921, with 23 members, and now has about 40. The membership is continuing to increase, and the Section expects to be able to retain the cup for at least another year.

Papers of particular interest, other than those mentioned above, were "Drilling and Care of Deep Wells," by J. C. Godfrey; "Design and Use of Centrifugal Pumps," by T. C. Heyward; "Use of Oxy-acetylene Torch in Water Works Practice," by J. C. Michie; "Use of Deep Well Water to Save Alkalinity," J. C. Womble; "The Laboratory Control of Filtration," by G. D. Norcom; "Operation of a Small Filter Plant," by R. J. Ward of Zebulon; "The Importance of Filter Sand and Gravel in Filtration Plants," by A. O. True; "Operation of Mechanical Filters with Value of Simple Laboratory Tests," by W. M. Turner; "The Lexington, N. C. Filtration Plant," by W. L. Jones; "Operation of Chlorine Control Apparatus," by P. J. Dishner; "Economical Control of Chemical Dosage in Filtration Plants," by R. A. Maddock of Charlotte; "The Operation and Care of Centrifugal Pumps," by R. M. Alexander, and "Combustion of Coal in Boiler Furnaces," by A. McK. Maffitt.

A noteworthy feature of the meeting, of especial interest to filtration plant operators was the presentation of the paper by E. J. Theriault of the U. S. P. H. S. on "Use of Hydrogen Ion Determinations." Dr. Theriault gave an interesting and non-technical discussion on what hydrogen ion determinations mean to the water works operator, and the lines along which studies are being prosecuted to make this determination of greater practical value. Following Dr. Theriault's address, Mr. Cattlett of the State Board of Health and Mr. Norcom of Wilmington described investigations being conducted in this state on hydrogen ion determinations. Whereas, Dr. Theriault had found that a Ph. value of 5.5 gave generally optimum conditions for precipitation of a floc from aluminum sulphate, in this state the Ph. value for good precipitation ranged from 4.2 at Wilmington to 6.6 at other places, depending upon the local characteristics of the water being treated.

The success of the meetings was due largely to the untiring efforts of the enterprising City Manager of Gastonia, W. J. Alexander, who did not spare himself in putting every facility of his office at the disposal of the Section, as well as providing the use of the new filter plant for use at meetings and arranging for the complimentary dinner given those attending.

The officers elected for the ensuing year are: President, Ernest B. Bain, superintendent of water works, Raleigh; Vice-President, J. O. Craig, superintendent of water works, Salisbury; Secretary and Treasurer, Thorndike Saville, Professor of Hydraulic and Sanitary Engineering, University of North Carolina, Chapel Hill, N. C. The Section voted to hold its next annual meeting at New Bern, in the eastern part of the state.

PERSONALS

Cooper, Daniel C., formerly city engineer of Elkins, W. Va., has been appointed construction superintendent by the U. S. Gypsum Company at Oakfield, N. Y.

McCullough, E. W., of Indianapolis, has been appointed engineer for the designing and construction of a garbage disposal plant for that city.

Browning, Dewitt, has resigned as city engineer of Long Beach, Cal.

Richards, Charles Russ, formerly dean of the College of Engineering of the University of Illinois, was installed as president of Lehigh University on October 14.

White, H. Collins, formerly superintendent of the Dayton, Ohio, Water Works, has been employed in an executive capacity by the Linden Chemical Company of Dayton.

Mantel, L. W. B., of Uvalde, Texas, has been appointed city engineer at San Angelo.

Hinckley, G. S., city engineer of Redlands, Cal., is in charge of the flood control work at the headquarters of the Santa Ana River, undertaken by San Bernardino, Riverside and Orange Counties.

Keller, Henry A., formerly resident engineer with the North Carolina State Highway Department, has been appointed district highway engineer in Albermarle County, Virginia.

Lane, Joseph T., has resigned as commissioner of public works of Syracuse, N. Y. He has been succeeded by Duncan W. Peck.

Blair, John E., has been appointed city engineer of Mineola, Tex.

Reed, Howard S., recently associated with Sheldon K. Baker, of Phoenix, Ariz., has been appointed city engineer of that city.

BOOK REVIEW

"MOSQUITO ERADICATION," by W. E. Hardenburg. 246 pages, 146 illustrations. Published by McGraw-Hill Book Company. This is believed to be the only book, other than reports of federal, state and local commissions and officials, that deals exclusively with mosquito eradication, and is certainly most complete. The author states that he himself knows of no comprehensive book on the subject except one by LaPrince and Orenstein on "Mosquito Control in Panama." The author has had considerable experience with the U. S. Public Health Service, and has drawn upon the reports issued by this and other federal departments for much of his material.

The chapters deal with: "The Toll of the Mosquito," "Some Disease-Bearing American Mosquitoes," "Development of Control Measures," "Initiating the Campaign," "Administrative Aspects of the Campaign," "Inland Drainage," "Salt Marsh Drainage," "Oiling," "Fish Control," "Screening," "Other Measures and Expedients and Points Requiring Investigation," "Rural Mosquito and Malaria Control," and four appendices, one tabulating the points of differentiation between the different species of mosquitoes; another giving an anti-mosquito ordinance; a third giving a suggested anti-mosquito leaflet for educational work, and the fourth being a bibliography of the subject.

A special feature of excellence is the practical nature of the instructions for carrying out the various work, both those of an engineering nature and those for oiling, fish control, etc.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

THE AUSTIN PUP

Specifications of the Illinois State Highway Department call for a 3-ton power roller, and to meet this the Austin-Western Road Machinery Company is ready to furnish a small 3-wheel road roller weighing only 3 tons which is called the "Austin Pup." This is believed to be the first 3-wheel power roller weighing less than 7 tons. In addition to preparing the subgrade by bringing it to true surface, it will pull a wheel or drag scraper or fresno or a small road machine or plow or anything else that a small tractor will do. It can also be used for rolling gravel, stone or earth roads, drives in parks and cemeteries, etc.

By combining the essential features of a Fordson tractor with the other features of the Austin gas roller the company is able to sell the Austin Pup at a much lower price than would be possible in any other way. In addition, the purchaser can obtain repair parts of the tractor from any Ford agent.

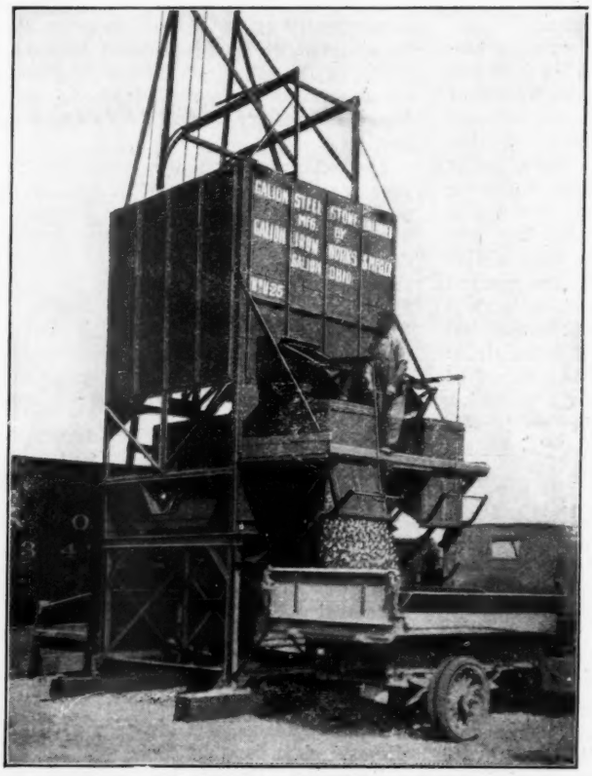
The total length is 12 feet 6 inches, total width 5 feet, each rear roll is 42 inches diameter and 18-inch face and front roll 28 inches diameter and 15½-inch face. The weight on the rear rolls is 4,120 lbs. and on the front rolls 1,880 lbs. The road speeds are 1.48 miles per hour low and 2.73 miles high, with 2.61 miles reverse.

THE EUREKA SNOW PLOW

A special double-strength plow known as "The Eureka" has been designed and is being built for use with the crawler type of tractor by the W. M. Toy Company. An elevated nose in front of the plow causes it to pass over stones or other hidden obstructions without lessening the speed of the tractor and independent of the attention of the driver. It is claimed to be securely built and braced so that it will not jack-knife. The forward end of the plow is carried on an I-beam runner that curves upward in front of the angle to lift it over obstructions, and the rear ends of the wings are also carried on runners curved at both ends to permit the plow to be drawn backwards when desired. These runners carry the weight of the plow at all times. The plow is pushed by driving bars composed of two 3-inch channels on each side of the tractor, which are pivoted to the rear of the plow and to a compensating bar pivoted centrally with the rear axle, which insures an equal distribution of power to the driving bars regardless of the angle of plow or tractor. The wings are 24 inches high and 7 feet long and the spread of the plow is 9 feet. The weight is 700 lbs., ready for shipment.

NEW FORM OF EXPANSION JOINT

A new form of the Carey Elastite Expansion Joint is being furnished by the Philip Carey Company and has been accepted by the Illinois State Highway Department and approved by that of the State of Michigan. It is known as a tongue-and-groove expansion joint and was developed to fill the specific need of a longitudinal joint for concrete roads that would prevent spalling and crushing of concrete at the joint due to slab movement, maintain constantly a watertight seal and, by interlocking action, hold adjacent slabs to uniform surface alignment, making it impossible for one slab to settle below or rise above its neighbor. The material used is the same as in the joints heretofore manufactured by this company.



GALION BATCH MEASURING HOPPER.
Operator releasing trip lever which permits swinging side-door to open and dump the measured quantity of 20 cu. ft. of crushed stone into truck below.

BATCH MEASURING HOPPER

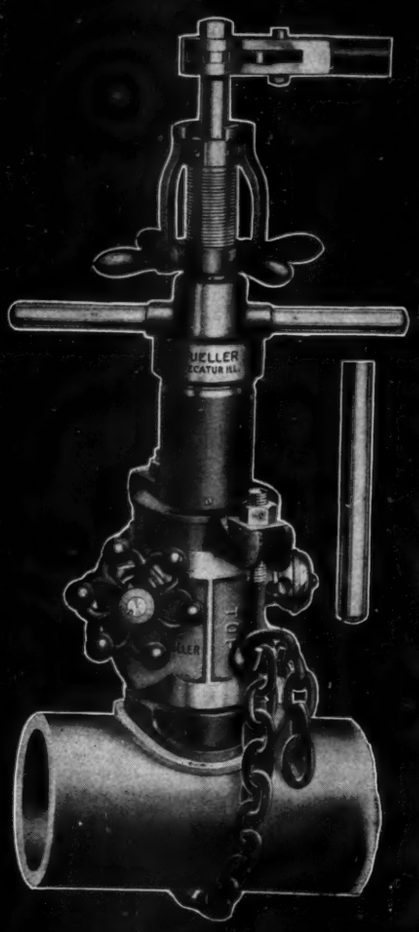
A batch-measuring hopper for accurately measuring crushed stone, sand, gravel or similar material being discharged from the bin into trucks or wagons is manufactured by the Galion Iron Works and Manufacturing Company. The hoppers can be attached to the bin of any Galion car unloader, gravel screening plant, or to any portable or stationary bin. They provide for the contractor a simple and efficient method of quickly and accurately measuring aggregate. They are operated by an attendant on a convenient platform, who has ample time for refilling the empty hoppers while waiting for a loaded truck to withdraw and an empty one to take its place. It is claimed that with the use of these hoppers and sufficient trucks, a car of aggregate may be unloaded and accurately measured batches dumped into the trucks and hauled away in two hours or less time, depending on the number and speed of the trucks.

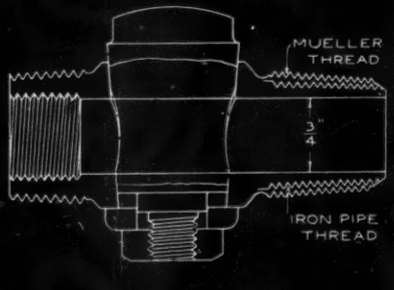
The hopper is made of heavy sheet steel throughout, no wood entering into the construction. It is regularly made in sizes of 10 or 20 cubic feet capacity, but other sizes will be made to suit requirements. The chute is provided with a semi-circular steel hinged gate, while the bottom of the hopper slopes at an acute angle which causes it to empty quickly as soon as the swinging dumping door, which constitutes one side of the hopper, has been released.

The illustration shows the operator releasing the trip lever of the hopper door and discharging 20 cubic feet of crushed stone into the truck below.

TYPE 15 AIR COMPRESSORS

A new line of small, vertical, belt-driven air compressors, known as "Type 15" is announced by the Ingersoll-Rand





The Value of the Mueller Thread

A tap made with the *MUELLER* Thread sinks a cone-shaped hole in the water main, slightly narrower on the inside than on the outside surface of the main.

A Corporation Cock with the *MUELLER* Thread screws into this hole *like a wedge* — the more you screw it, the tighter it fits. That's why the patented

Mueller "B" Tapping Machine

does such effective work — tapping and inserting corporation cocks under pressure, from ⅜" to 1" — and tapping only from ⅜" to 2" in open or dry pipe.

MUELLER made the *first* Tapping Machine to successfully insert a corporation cock under pressure. Today *MUELLER* Machines make 90% of all the taps for American Public Service Companies.

For descriptions and prices, write to

H. Mueller Mfg. Co., Decatur, Illinois

PHONE BELL 153

Water, Plumbing and Gas Brass Goods and Tools

New York City, 145 W. 30th Street
Phone Watkins 5397

San Francisco, 635 Mission Street
Phone Sutter 3577

Sarnia, Ontario, Canada

Mueller Metals Co., Port Huron, Mich., Makers of "Red Tip" Brass Rod; Brass and Copper Tubing; Forgings and Castings in Brass, Bronze and Aluminum; Die Castings in White Metal and Aluminum; also Screw Machined Products.

Company. Each size is built both of plain, belt-driven design and also with a self-contained electric motor outfit driven either through pinion and internal gears, or by short belt drive. The compressing end and electric motor of both gear and short belt drives are furnished mounted on common sub-base.

Among the special features of construction, the constant level lubrication system is the most important, others being the constant-speed unloader for plain belt drive, the centrifugal unloader for start and stop control machines, and the increased size of the water reservoir cooling pot. The constant level lubrication system automatically maintains a constant level of oil, insuring the right amount being discharged to all parts. Pet cocks determine the maximum and the minimum amount of oil in the reservoir. Above the reservoir and directly beneath the connecting rod is a constant-level pan, into which oil is pumped from the reservoir into this pan through an oil pump. A projecting stem on the connecting rod dips into this pan and distributes just a sufficient quantity of oil for proper lubrication.

The constant-speed unloader controls the unloading of the compressor by automatically opening the inlet valve when the receiver pressure rises above a predetermined amount, and when it falls a predetermined amount the unloader automatically releases the inlet valve and again starts the compressor. The centrifugal unloader allows the compressor to start under no load, which is necessary for automatic starting and stopping, and permits the electric driving motor to come up to full speed before the load is thrown on automatically.

The smallest size of these compressors is either air-cooled, where the service is intermittent, or water-jacketed for constant service. All other sizes are built with water jacket of the reservoir type and of generous size.

THE TRAFICON

A traffic light set in the pavement at a street intersection is being manufactured by the Line Material Company under the name of "Directing Traficon" and "Regulating Traficon." The former consists of a heavy steel casting extending 8½ inches above the street surface and containing on each side a bullseye lens set in a recess perpendicular to the pavement and protected on each side by a heavy flange. Light is thus thrown down each of the four intersecting streets. If desired, red lenses can be placed in the line of one street and green lenses in that of another. Being low-lying, the "traficon" is directly in the line of the driver's vision and compels attention. It is rugged enough to withstand severe shocks.

The "Regulating Traficon" contains a stop light surmounting the hood, the extinguishing of the "stop" light being permission for the traffic to "go." "Traffic change" is indicated by a winking of the light above the lens. The device can be set to operate automatically or can be under the control of an officer standing at the street curb.

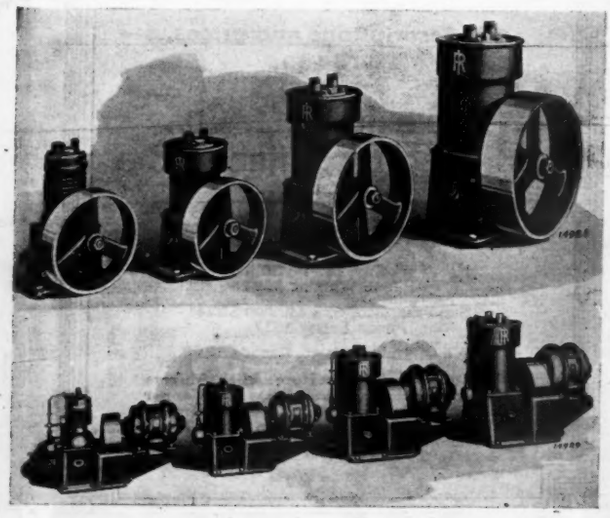
AVERY 20-35 H.P. TRACTOR FOR 1923

The Avery Company announce for 1923, an improved 20-35 H.P. tractor. The most noticeable change is in the external appearance. The cab has been eliminated, the fenders cover the full width of the rear wheel and extent from the platform well over more than half their circumference. The hood running back from the radiator includes the fuel tank and affords a substantial cover protection for the motor.

The power of the motor is increased 25 per cent and the Company has adopted a cooling system with cellular radiator, water pump and fan, and the Madison Kipp mechanical lubricator for oiling the working parts of the motor. The weight of the tractor is 7,500 lbs. which is considered very light for the drawbar efficiency.

DIRECTING TRAFICON.

REGULATING TRAFICON.



TYPE FIFTEEN AIR COMPRESSORS.

3"x3" air cooled, and 3"x3", 3½"x4" and 4½"x5" water reservoir cooled machines. Upper row — Belt-driven.

Lower row — Electrically-gear-driven.

INDUSTRIAL NOTES

RESEARCH ON STEEL PIPE CORROSION

The National Tube Company has established an industrial fellowship in the Mellon Institute of Industrial Research of the University of Pittsburgh, the aim being a systematic study of practical methods for preventing corrosion of hot water supply systems; also giving attention to the classification of waters of various chemical compositions with respect to their relative corrosive action upon iron and steel, particularly in the line of pipe lines, boiler economizers, tubes, etc. The present incumbent of the fellowship is Clifford R. Texter.

AUSTIN MACHINERY CORPORATION

The Austin Machinery Corporation has consolidated the main sales office at Chicago with its Engineering and Production department at 3,500 Dorr street, Toledo, Ohio. This will lend dispatch to the handling of orders for both machines and repairs and will be of mutual benefit to both the Austin organization and its many customers. However, a branch sales office will be maintained at Chicago, Suite 603, Railway Exchange Building, for the convenience of contractors in and near Chicago.

$ SAVED IN REPAIRS

Note the Slitted Brass Collars

These collars open under excessive pressure caused by frost allowing top and bottom casings to part without damaging the meter in any way. After freezing, the slitted collars can be reclosed and the meter bolted anew.

WHY TAKE CHANCES?

Every meter damaged by frost means interrupted service, loss of time in repairs and cost of new parts.

LAMBERT FROST PROOF METERS

THOMSON METER COMPANY

100-110 BRIDGE ST., BROOKLYN, N. Y.

LAMBERT FROST-PROOF METERS

New Catalogs of Interest to City and County Engineers, Superintendents of Water Works, Superintendents of Streets, Contractors and All Engaged in Public Works

If you want any of these Catalogs, write the number on a postal, sign your name and address plainly, and mail it to PUBLIC WORKS, 243 West 39th Street, New York. The Catalogs will be sent to you promptly without charge or obligation.

CRANE EXCAVATORS

490. The Koehring Company, Milwaukee, Wis. Bulletins describing Crane Excavator No. 2 and Crane Excavator No. 3, the former having a 70-H.P. engine and the latter a 100-H.P. Gives detailed description of make, capacity, etc. 8 pages, 8x10-1/2.

NON-DETOUR ROAD CONSTRUCTION

491. Warren Bros. Company, Boston, Mass. Features the fact that traffic can continue to use a road where Warrenite-Bitulithic or Warren Pavement is under construction. 16 pages, 6x9.

MOUND TRAFFIC MARKER

492. Mound Traffic Equipment Co., Columbus, Ohio. Illustrates and describes the Mound Marker for directing traffic at street intersections. 4 pages, 8-1/2x11.

TREATED TIES AND TIMBERS

493. Century Wood Preserving Company, Pittsburgh, Pa. Discussion of the advantages of wood preservation and the processes used therefor, including use of creosote and zinc chloride. 24 pages, 8-1/2x11.

TIME STUDY OF CURB CONSTRUCTION

494. The Heltzel Steel Form & Iron Company, Warren, Ohio. Gives actual costs of setting Heltzel forms for concrete curb and roadway on a city street. 4 pages, 8-1/2x11.

AUSTIN-WESTERN SWEEPERS

495. Letters from city officials of Detroit, Niagara Falls and Jacksonville, giving actual figures as to amounts of work done, unit costs, etc., in the use of Austin-Western sweepers for street cleaning. 21 pages, 8-1/2x11.

CONTINUOUS FILTERS

496. Oliver Continuous Filter Company, San Francisco, Calif. Description of continuous automatic vacuum filters, horizontal filter tables, and vacuum and other pumps. Has been experimented with for de-watering sewage sludge. 4 pages, 8-1/2x11.

STEAM-DRIVEN AIR COMPRESSORS

497. Westinghouse Traction Brake Company, Pittsburgh, Pa. Description of steam-driven air compressors of the cross compound type. Small portable plants used for road-building and other construction work. 12 pages, 8x10-1/2.

WESTINGHOUSE AIR COMPRESSORS

498. Westinghouse Air Brake Company, Pittsburgh, Pa. Complete catalogue of steam-driven, motor-driven and belt-driven air compressors and accessories manufactured by this company, together with tables of reduction of air volume under pressure, velocity of air through orifices, etc. 100 pages, 6x9.

HOT-WATER METERS

499. Simplex Valve & Meter Company, Philadelphia, Pa. Catalogue of hot water meters and meter registers. 8 pages, 4x10-1/2.

RECORDING THERMOMETERS

514. The Foxboro Company, Inc. Foxboro Recording Thermometers are described and their advantages set forth in a four-page leaflet, 9½ x 12.

BALMER REFUSE DESTRUCTORS

515. "Refuse Collection and Disposal" and "The Refuse Disposal Problem in Small Communities." Two pamphlets, of 18 and 12 pages, respectively, issued by the Balmer Corporation, describing the Balmer destructors in Buenos Aires and Montevideo.

MORSE-BOULGER DESTRUCTORS

516. Pamphlet describing Morse-Boulger destructor and giving suggestions for preparing plans for refuse destruction service. 18 pages, 6x9 ins.

STREET SWEEPING SUPPLIES

517. Catalogue of rattan, corn, bamboo, hickory and wire push brooms, and street sweeper brooms, and street scrapers. 111 pages, 5x7 ins.

FOX ROTARY SNOW BROOM

518. Describes attachment to be mounted on any standard chassis manufactured by the Fox Rotary Snow Broom Co. and used last winter for opening snow-covered highways. Also used for summer sweeping. 12 pages, 6x9 ins.

WATSON DUMPING WAGONS

520. Descriptions and specifications of grading, ash and asphalt bottom-dump wagons of various capacities and styles. 32 pages, 10x7 ins.

STREET CANS

519. Describes waste paper and white wing cans made by the Cleveland Wire Spring Co. 1 page, 6x9 ins.

COLUMBIAN WAGONS AND CARTS

521. Catalogue of farm, bottom dump, end dump and wet garbage wagons, and carts. 40 pages, 7½x9½ ins.

GARBAGE CARTS AND WAGONS

522. Catalogue of steel body round-bottom carts, and end-dump carts and wagons, made by Geo. H. Holzbog & Bro. 12 pages, 7½x10 ins.

INDUSTRIAL NOTES

(*Continued from page 24*)

LARGE VALVES IN DETROIT FILTER PLANT

Detroit's new $6,000,000 filter plant is practically completed except for placing the filtering medium. Among the interesting features of this plant are the large sluice gates built by the Michigan Valve and Foundry Company, which made all of the special fittings. There are three pairs of gates, measuring 24 ft. x 5 ft., 14 ft. x 8 ft. 6 in. and 7 ft. x 9 ft. respectively. The 24-foot gates are the largest leaves of their type in use. In each case large size was necessary because there was not sufficient space available for double gates; therefore one huge gate was built by bolting together two separate castings. The 14 ft. x 8 ft. 6 in. gates have even larger area, and are said to be the largest single casting leaves that have been built. Here, too, spaces only 18 feet long were available, making it impossible to employ double gates with the necessary concrete walls between them. The 7 x 9 foot sluices operate automatically, and are designed to maintain a constant level in the settling basin.

MOTOR TRUCKS FOR 1923

The Federal Motor Truck Co. announces an entirely new line of trucks for 1923. The new models include a 1 to 1½ ton, pneumatic tire; a new 2½ ton; 3½ to4 ton; 5 to 6 ton; and both light and heavy duty trailer tractor.

The 2½ ton is made with four wheel bases—120 inches (short), dump chassis 144 inches, standard 156 inches, and 168 inches (long). The new model is slung much lower than the average truck, the clearance from ground to frame when loaded being 30½ inches. The wheels are artillery type. The motor is a Continental vertical L head type, developing 35 horsepower at normal engine speed.

The 1 to 1½ ton will have a 30 h.p. motor; the 3½ to 4 ton will have a 42 h.p., and the 5 ton a 46 h.p. The light tractor will have a 30 h.p. motor, and the heavy tractor a 42 h.p.

WATER METERS

FOR EVERY KIND OF SERVICE

Also Meters for Gas, Oil, Gasoline, Air and Other Fluids

Arctic

Eureka

Accuracy Efficiency and Continued Satisfactory Service at the lowest Maintenance Expense are Characteristic of these Meters.

Keystone-Compound

Keystone

PITTSBURGH METER COMPANY

GENERAL OFFICE AND WORKS, EAST PITTSBURGH, PA.

SALES OFFICES

NEW YORK, 50 Church Street
CHICAGO, 5 S. Wabash Avenue
KANSAS CITY, Mutual Bldg.
COLUMBIA, S. C., 1433 Main Street
SEATTLE, 882 Madison Street
LOS ANGELES, Union Bank Bldg.

The Winter Peril

of Frozen Hydrants is Removed with the ROSS THAWING DEVICE

THE fire alarm on a zero day fills firemen's minds with apprehension as to the possibility of a frozen hydrant, and the incidental delay in fire fighting.

The Ross Thawing Device will quickly and effectively overcome this handicap. It consists of a jacket tank surrounding a steam coil, and operated on the flash boiler principle, producing steam at the nozzle twenty seconds after the flame is lighted.

The water, which is forced from the tank into the red hot coil, by means of hand pump, becomes superheated steam which will thaw more quickly than any other known agent. The heat is furnished by a standard Prestolite Acetylene tank, which is part of the outfit.

Ready for operation, the Ross Thawing Device is 25 inches tall, and weighs only 135 pounds. 28½x12 inches at the base; easily portable. Simple in operation.

Every fire department should be equipped with one or more of these devices.

Upon receipt of your request our nearest branch office will immediately forward you complete information and prices.

AMERICAN-LAFRANCE FIRE ENGINE COMPANY, INC.

ELMIRA, N.Y.

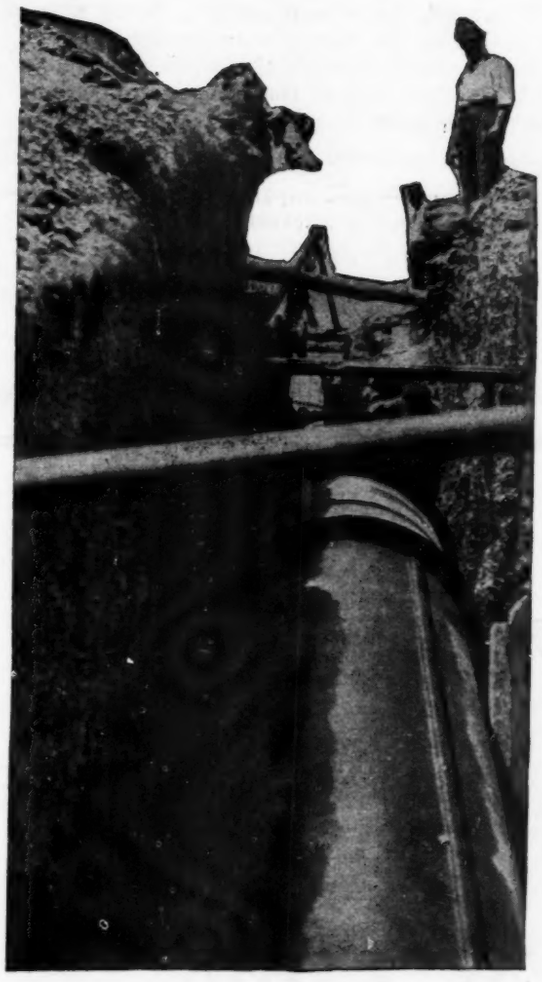
BRANCHES
NEW YORK
BOSTON
ATLANTA
PITTSBURGH
CHICAGO
DALLAS

CANADIAN FACTORY
TORONTO, ONT.

BRANCHES
DENVER
MINNEAPOLIS
LOS ANGELES
SAN FRANCISCO
WASHINGTON
PORTLAND

LOCK-BAR

STRONG AS THE *Before Closing* PLATE ITSELF



The Only Pipe with the 100% Joint

Lock-Bar Steel Pipe will carry approximately 43% greater working pressure than double riveted steel pipe. The longitudinal joint of Lock-Bar is 100% efficient.

On account of the smooth interior of Lock-Bar (absence of rivets, except at circumferential joints thirty feet apart), Lock-Bar is given a preference of 3 inch in diameter over riveted pipe for same carrying capacity.

For like capacity and like pressures Lock-Bar has the advantage of saving in metal on account of smaller diameter and thinner plate. The saving increasing with the diameters and pressures.

Executives write for "Handbook on Pipe"

EAST JERSEY PIPE COMPANY

7 DEY STREET **NEW YORK**

ACCURATE DURABLE
DEPENDABLE

"WATCH DOG"
FROST PROOF METERS

effect an enormous saving in labor and repairs

The Frost Proof Meter may be had in all sizes up to and including 1¼".

The frost plate or bottom cap is brass lined as an added protection to the working parts.

The cap is designed to break when subjected to undue strain. When this fracture occurs, only the plate is damaged, the measuring unit being saved from distortion by the play afforded by the loosened plate. Replacement is easy—the cap is removed, a new one is replaced, and all that remains to be done is to pull up the bolts.

A hammer is unnecessary; no blows are required.

Waterworks officials and superintendents will find our catalogue of special interest.

GAMON METER COMPANY

280-294 SOUTH STREET NEWARK, N. J.

Chemicals for Water Purification

We manufacture the highest grades of

Sulphate of Alumina

also

Chloride of Lime

and

Liquid Chlorine

Pennsylvania Salt Manufacturing Company

WIDENER BLDG. PHILADELPHIA, PA.

MAKE YOUR SERVICE CONTROL 100% EFFICIENT

BY THE ADOPTION OF THE

C.M.B. SERVICE BOX

ELIMINATES ALL TROUBLE

No more broken nor lost bolts, nor tops.

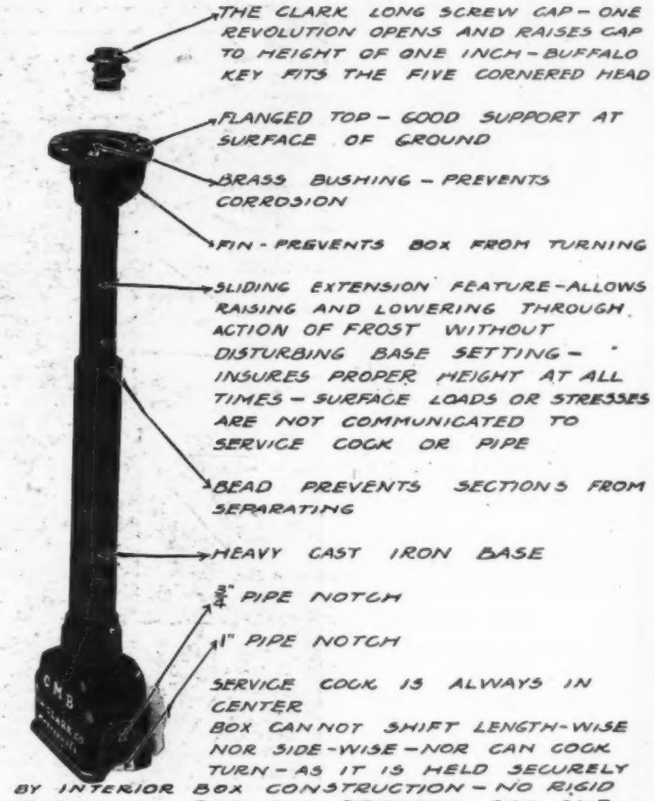
No more digging up to adjust to grade.

No more trash filled boxes.

No more damaged service cocks or leaky pipes caused by heavily loaded wagons.

No more inoperative cocks by reason of failure to engage key.

Uniformity on all services, as same box fits all sizes up to 2″ inclusive.


THE CLARK LONG SCREW CAP – ONE REVOLUTION OPENS AND RAISES CAP TO HEIGHT OF ONE INCH – BUFFALO KEY FITS THE FIVE CORNERED HEAD
FLANGED TOP – GOOD SUPPORT AT SURFACE OF GROUND
BRASS BUSHING – PREVENTS CORROSION
FIN – PREVENTS BOX FROM TURNING
SLIDING EXTENSION FEATURE – ALLOWS RAISING AND LOWERING THROUGH ACTION OF FROST WITHOUT DISTURBING BASE SETTING – INSURES PROPER HEIGHT AT ALL TIMES – SURFACE LOADS OR STRESSES ARE NOT COMMUNICATED TO SERVICE COCK OR PIPE
BEAD PREVENTS SECTIONS FROM SEPARATING
HEAVY CAST IRON BASE
¾" PIPE NOTCH
1" PIPE NOTCH
SERVICE COCK IS ALWAYS IN CENTER
BOX CANNOT SHIFT LENGTH-WISE NOR SIDE-WISE – NOR CAN COCK TURN – AS IT IS HELD SECURELY BY INTERIOR BOX CONSTRUCTION – NO RIGID CONNECTION REQUIRED BETWEEN BOX AND SERVICE COCK
C M B
CLARK CO

THINK WHAT THIS MEANS TO YOU

Furnished in base for lead pipe and base for Minneapolis pattern cock; also with extension rods and combination keys when desired.

Perfectly adapted to use everywhere regardless of type of box now in use. It does not require additional number of wrenches nor keys.

A wonderful LIGHT WEIGHT WRENCH made up of tubing and fitted with steel key to operate top and fitted with steel combination base to operate cock or to operate extension rod. Your department equipped with CLARK WRENCHES greatly facilitate operation, one wrench ONLY being required to operate all Service Cocks of all sizes up to 2″ whether equipped with rod or without rod. We arrange to equip you with these wrenches free.

You will be surprised at the low price. Ranks with the lowest priced Service Boxes on the market.

ADOPTED BY MANY WATER DEPARTMENTS

Clark Meter Boxes—Southern
Clark Meter Boxes—Northern
Clark Meter Testing Machines—Six Models—Bulletin B.
Clark Testing Instruments Increase Earnings—Bulletin C.
The New C. M. B. Service Box Corrects All Service Box Faults, Valve Boxes, Valve Housings, etc.—Bulletin D.
Water Works Pumps of All Kinds—Bulletin E.
Municipal and Miscellaneous Castings—Bulletin F.
Venturi Meters—Check Your Pumpage and Waste—Bulletin G.
CAST IRON PIPE, FIRE HYDRANTS and VALVES, AIR VALVES, BRASS GOODS, etc.—Bulletin H.

WRITE FOR BULLETINS

H. W. CLARK COMPANY

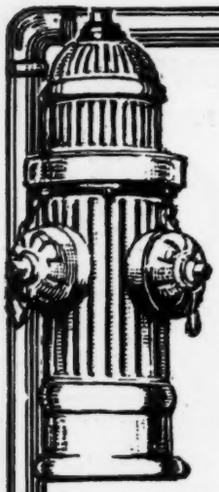
EVERYTHING FOR THE WATER WORKS AND MUNICIPALITY

1308 Broadway, MATTOON, ILLINOIS, U.S.A.

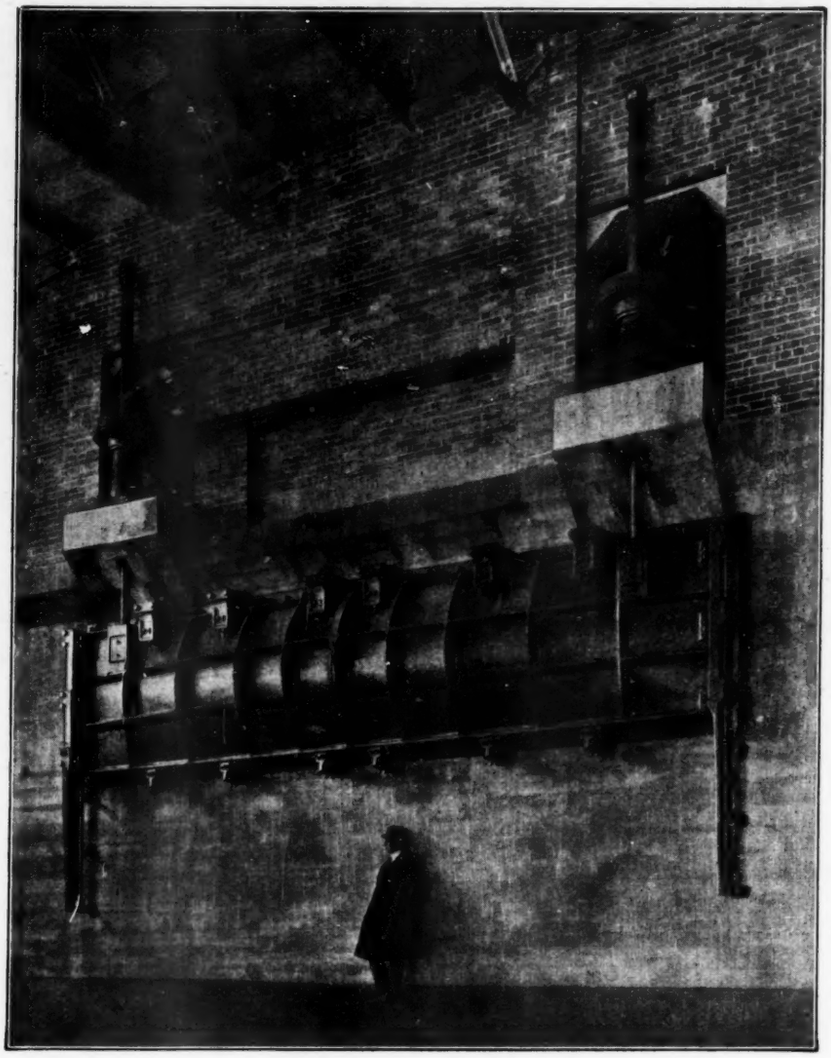
New York Salt Lake City Chicago
Memphis San Francisco Buffalo

THE CLARK METER BOX
TRADE MARK
PROTECTION

"GO AHEAD"



"Michigan" compression hydrants embody points of simplicity, efficiency and durability that make them the recognized standard in design.



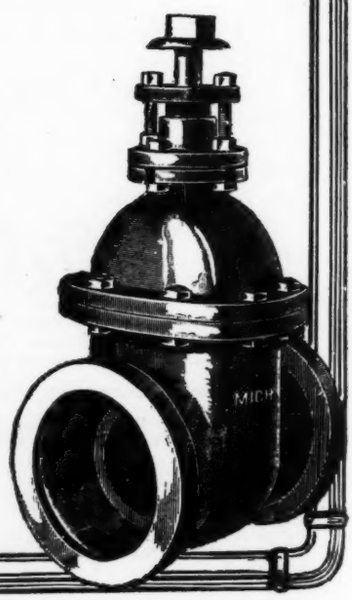
Big Tasks Well Performed

—a case in point

QUALITY and precision are the hall-marks of "Michigan" products. Backed by the experience of 55 years of effort intelligently directed, and spurred by a willingness to serve that is typified within the organization by the slogan, "Go Ahead," we are equipped and ready to execute commissions calling for the highest standards of dependability.

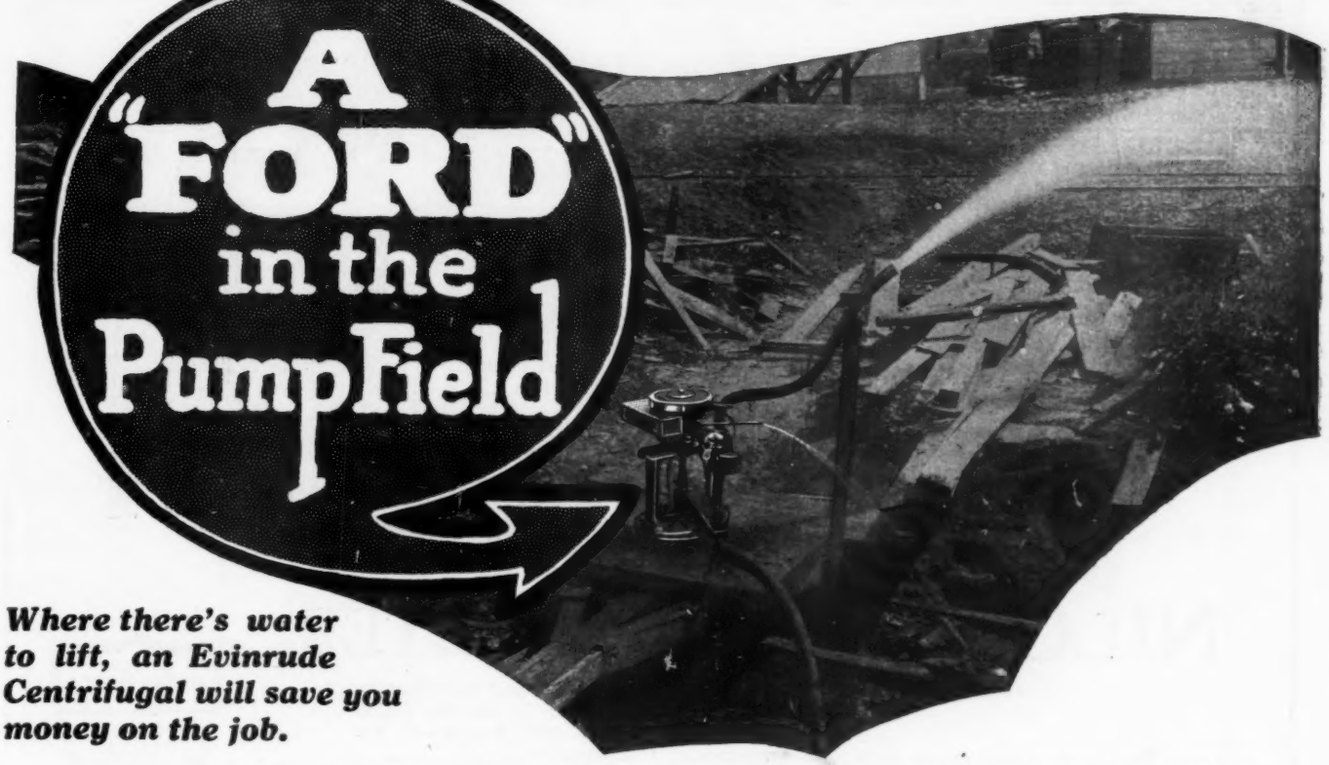
Reproduced above is a typical "Michigan" achievement—the largest single-leaf sluice gate in the world. It was produced by us to meet special engineering conditions presented in the construction of Detroit's new $6,000,000 filtration plant, the largest single-unit system of its type in existence.

Complete Catalog upon request.



MICHIGAN VALVE & FOUNDRY COMPANY
DETROIT, MICHIGAN

A "FORD" in the Pump Field



Where there's water to lift, an Evinrude Centrifugal will save you money on the job.

THAT'S the verdict of Evinrude Centrifugal Pump users all over the country.

For example, a Massachusetts contractor writes in: "I had four men with two sewer pumps trying to pump out a ditch and they could not keep ahead of the water. I installed an Evinrude Pump and in an hour I put my men to work on another job."

A road builder in Denver, Colo., writes: "No contractor on a road job can afford to be without an Evinrude Pump. Its dependability and portability make it so useful. If an emergency occurs at any place on the job, the Evinrude can be tossed in the back seat of the flivver and it will be at work in no time at all."

A Kansas City bridge builder says: "We have three gas pumps, two four-inch and one of your little units which we lower down in the casings, and after the larger pumps quit us the little Evinrude always holds the water at working level."

City fire departments, dredge companies, logging concerns, public service companies, irrigators and the score of other users of this husky pumping outfit report the same success.

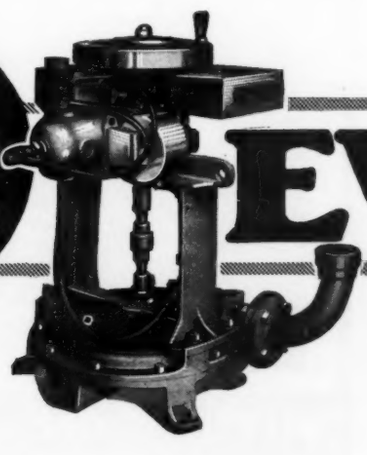
The Evinrude with its capacity of 5000 gallons of water at a 20-foot head is the only self-powered pump of its kind—driven by the same dependable 2 H.P. gasoline engine now used in 140,000 Evinrude rowboat motors. Weighs only 115 pounds—may be easily moved by two men. It is so compact it may be lowered into the ditch, caisson or excavation—right down to the job and submerged in the water. Can be used with or without suction line. No "installation" necessary.

Write for booklet illustrating the many uses of the Evinrude Centrifugal Pump.

Dealers: *Some desirable territory is still open. Write for our proposition.*

EVINRUDE MOTOR COMPANY
18 LAKE STREET MILWAUKEE, WIS.

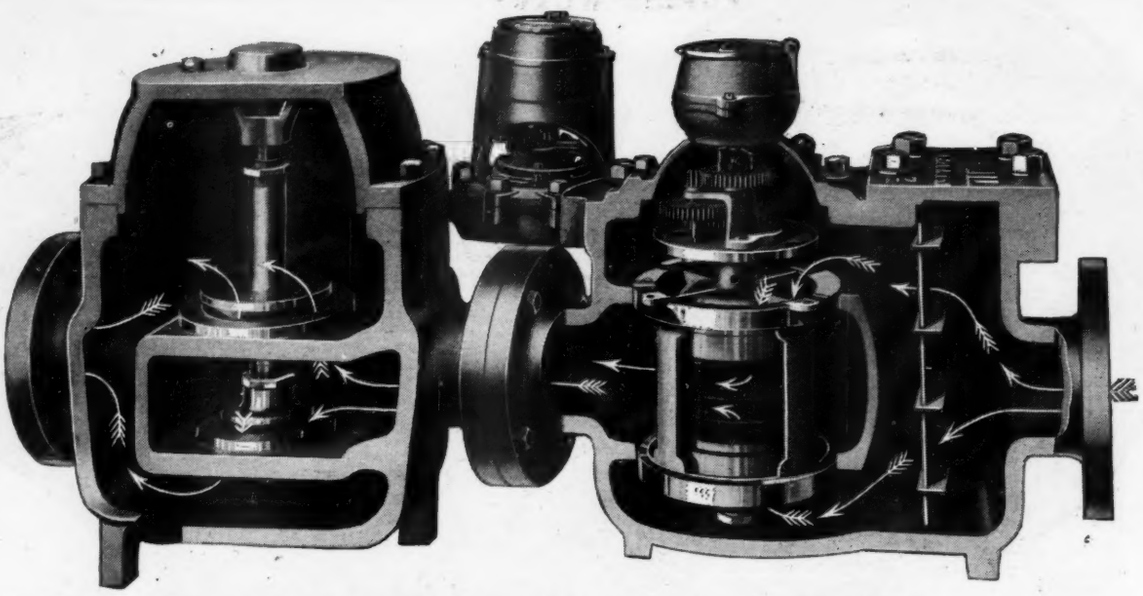
5000 GALLONS per hour at 20 ft. head



EVINRUDE CENTRIFUGAL PUMP

Price: $150.00 F.O.B. MILWAUKEE

For users requiring a more powerful pump the Evinrude No. 1½ is recommended. 7400 gallons per hour at a 20-foot head—3½ H. P. Evinrude motor. Price $200.



NILO COMPOUND METER

Consists of three separate and complete units which may be used individually, if desired. Working parts of Nilo Velocity Meters, King Disc Meters and Union Compounding Valves are each assembled in a single unit, readily accessible for inspection without disturbing pipe connections. Catalogue P-52.

Makers of approved water works specialties since 1868.

UNION WATER METER CO. *Incorporated* 1868 WORCESTER, MASS.

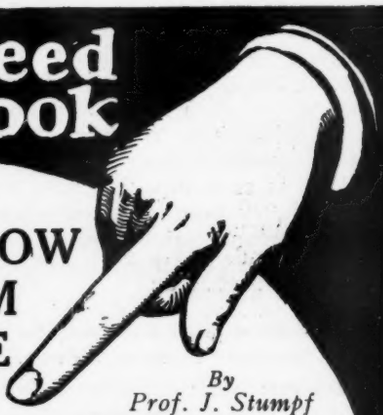
UNION WATER METER INC. CO 1868. WORCESTER MASS.

You need this book

on the

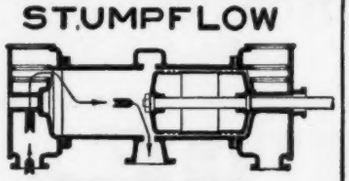
UNA-FLOW STEAM ENGINE

Second English Edition



By Prof. J. Stumpf

STUMPFLOW



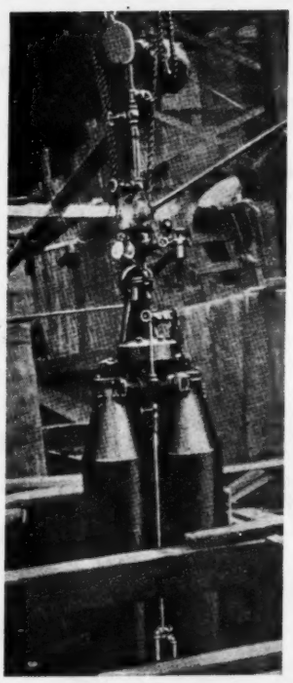
DESIGN

$5 postage prepaid

Write Now about your power problems to his own agent and engineers.

STUMPF UNA-FLOW ENGINE CO., Inc.
206 E. Genesee Street
SYRACUSE NEW YORK

EMERSON PUMPS

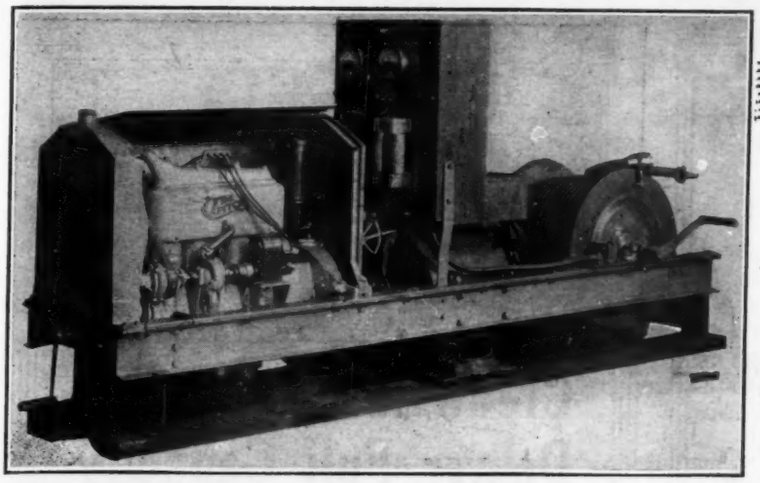


ON EVERY CONTRACT

The Emerson Steam Vacuum Pump is practically indestructible, is entirely self-contained, and has no working parts exposed or in sight. No foundation is required. Outside belting, shafting, or engine; self-priming and so simple that skilled attention is unnecessary. Ability to handle solid matter and entrained air without stopping, permits their use on work where other pumps are hopelessly inadequate. They will operate in any position. Requires no exhaust pipe. Steam consumption is low. Takes but little space in shaft.

Catalogue on request.

EMERSON PUMP and VALVE CO.
ALEXANDRIA, VA.



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GASO-ELECTRIC THAWING UNIT

Takes but 5 to 10 minutes to complete a thaw

This apparatus will more than save its cost in one season. Extremely low cost per thaw. A necessity to any city water department where freeze-ups occur during winter. No street disturbance or digging.

Engineers and contractors are requested to write for our proposition.

Manufactured by **Auto Engine Works,** *St. Paul, Minn.*

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FOR WATER WORKS

DEVICES FOR FILLING SPRINKLING WAGONS

WILL pay for themselves in savings effected on repairs to hydrants. Will save great waste of water, as regular hydrants when used are usually left in leaky conditions. No wrenches necessary to operate. Nothing to break. Nothing to get out of order.

PIPE CUTTING MACHINE

Cuts as easily and smoothly as if done in a lathe

No. 1.	Size for cutting 4", 6" and 8" pipe.
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Makers of Smith Tapping Machine, Valves, Lead Furnaces, Pipe Cutting Machines, Gate Valves and Other Water Works Specialties

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MATHEWS FIRE HYDRANTS

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The recognized standard for over 50 years

Frost-Proof
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Always Dependable

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FOR ALL PURPOSES

CAST IRON PIPE

AND FITTINGS

"REDUCED" FITTINGS

Write for Catalog and Prices

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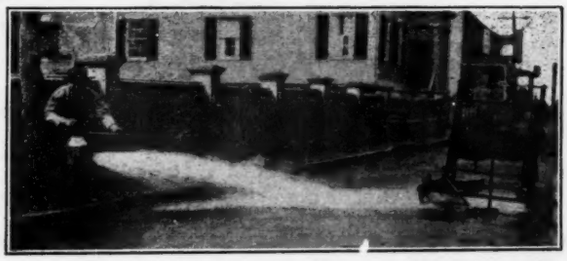
Philadelphia, Pa.



Clean Water Mains Deliver Full Capacity

If there is growth or deposit in your mains it will seriously affect the carrying capacity. It will cost a great deal less to send water through clean mains.

During the past 15 years we have cleaned mains in several hundred cities and the results in increased pressure and reduced operating costs have been thoroughly satisfactory.

We are glad to confer with municipal officials or water companies.

National Methods Are Patented

National Water Main Cleaning Co.

54 Church St. **New York**

Liquid Chlorine
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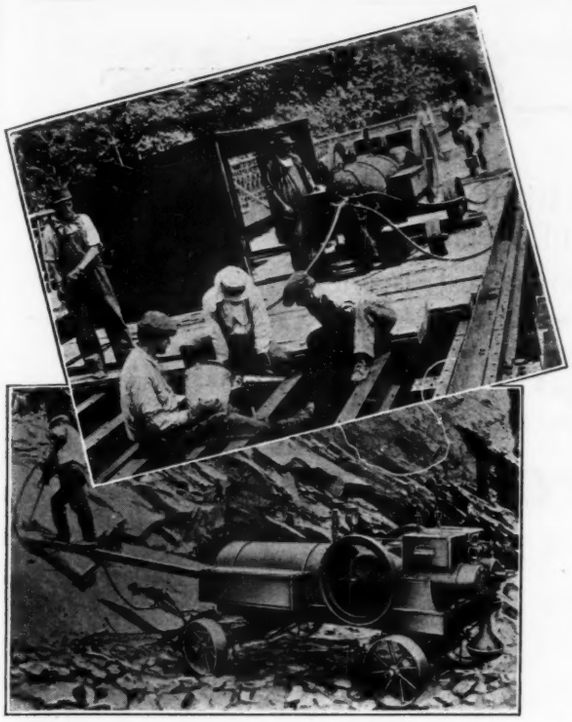
Your order for a 100-lb. cylinder of CHLORINE will be executed with the same care and promptness as that of a larger quantity.
By the same token and by reason of our facilities, we are able to dispatch a tank car with that same precision and exactitude.
Electro Bleaching Gas Co
PIONEER MANUFACTURERS of LIQUID CHLORINE
EBG



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Compressors
over 4000 in use!

The large number of "SCHRAMM" Compressors in use is the best evidence of the entire satisfaction which our customers have experienced with these units.

In addition to this over 70% of our business so far this year is traceable to satisfied users. This is the best recommendation that we can offer to support our claim that "SCHRAMM" Compressors are more efficient, more economical in operation, and more sturdily built than ever before.

Complete equipments can be had for rock drilling, riveting, woodboring, reaming, calking, tamping, sand blasting, paint spraying or any other pneumatic tool use. Tell us your requirements and let us send you bulletins describing your job with our recommendation.

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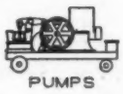
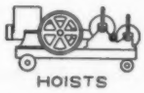
COMPRESSORS


PUMPS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BADGER WATER METERS

Positive and Accurate on all streams

From the Smallest Leak to the Full Capacity of Pipe

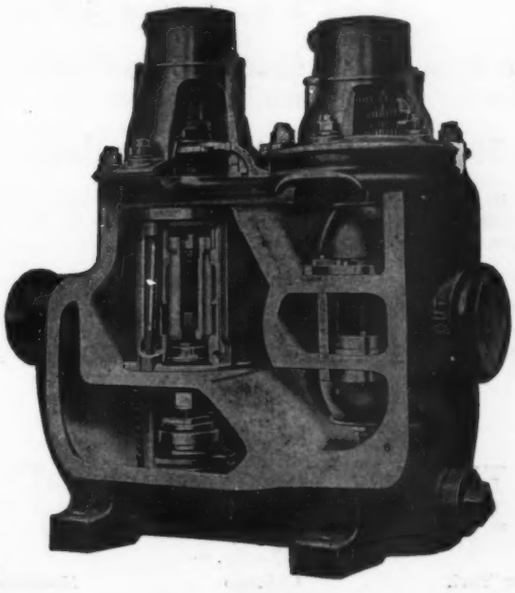
For Every Service

Our policy of selling a high-grade product is responsible for the greatly increased demand for Badger Meters.

We have the factory facilities and sales organization to handle a rapidly growing business.

Our special bulletin describing the Badger Compound Meter illustrated herewith will be sent upon request. Also bulletins on Disc Meters in sizes ⅝" to 4" inclusive, and on Turbine Meters in sizes 2" to 6" inclusive, if you wish them.

Write us your requirements



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FACTORY AT MILWAUKEE, WIS.

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WATER PIPE—GAS PIPE

NATIONAL Pipe is Made Right—On New Equipment—By Use of Special Cores.

NATIONAL Pipe has Smoothest Inside Finish—Easiest to Work.

PROMPT SHIPMENTS

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One Billion GALLONS

The total daily capacity of municipal filtration plants installed by us.

500 Communities Supplied

The Dry Feed machine illustrated is the most approved method of feeding chemicals in the science of water treatment. Overcomes the necessity for solution tanks.

The most perfect method of feeding chemicals in dry or powdered form.

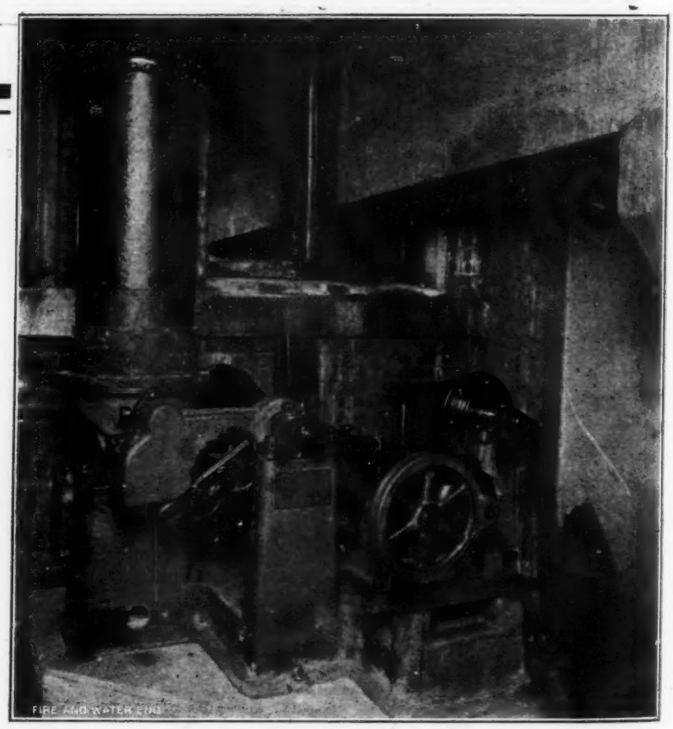
NOT AN EXPERIMENT but a PROVEN SUCCESS

Send for bulletin 22-2

The New York Continental Jewell Filtration Company

Nutley, N. J.

New York **Chicago** **Montreal**

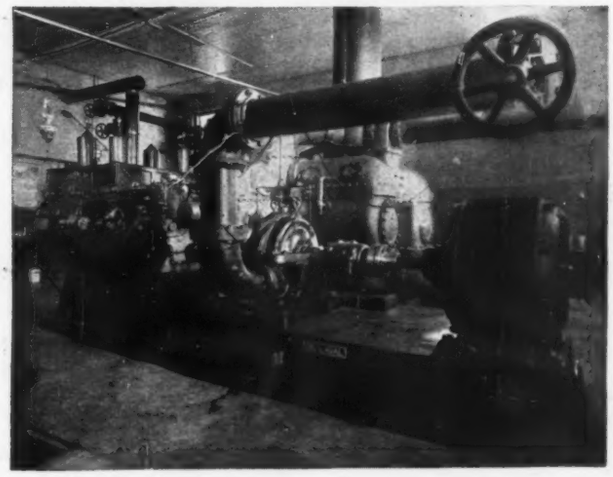


The ORIGINAL DRY FEED MACHINE

Sterling
THE ENGINE of REFINEMENT
For the finest boats that float

POWER INSURANCE

Use STERLINGS during emergency (storms or mechanical breakdowns), for peak load, and to reduce power costs for fire protection. State boards of health frequently insist on duplicate power in sewage systems. Fire underwriters demand a secondary power and often lower the insurance rate, or raise it if a standby unit is not used. Costs $20 to $25 per H. P.



6 cylinder 145 H. P. STERLING direct connected 2 stage DeLaval centrifugal, 1500 R. P. M. 1½ million gal. per day, 280 ft. head. Reserve pump installed at Bath Water district, Bath, Me. By Power Equipment Co., Boston, Mass.

STERLING ENGINE CO., Dept. C-5 BUFFALO, N. Y.

40 to 300 H. P. at 1200 to 1500 R. P. M.

THIRTY INCH PIPE LINE

Cast Iron Pipe at Syracuse

Showing Bell and Spigot Joints

Few cities are lucky enough to have a supply of pure water available within their limits. Syracuse, N. Y., is no exception to this rule. There the lake from which they obtain their water is located 20 miles away over the hills.

When their supply line was laid out, a desire to practice true economy led to the installation of a permanent material. U. S. Cast Iron Pipe was purchased and installed. The supply line consists of over nineteen miles of 30″ pipe and a mile and a half of 42″ pipe. In spite of the rough country through which this line was laid it has given perfect satisfaction and will serve the community for decades to come.

United States Cast Iron Pipe & Foundry Co.

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Bourbon Fire Hydrants, Gate Valves

AND

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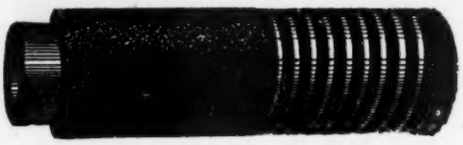
THE BOURBON COPPER AND BRASS WORKS CO.

618-620 E. FRONT ST. CINCINNATI, OHIO



It Carries More Water for Its Diameter Than Any Iron Pipe

WYCKOFF WOOD PIPE is not impaired by the effects of electrolysis acid fumes or corrosion. It is light, strong and very durable. Lengths, 6 feet to 12 feet long. Size for size, it carries 14 per cent. more water than iron pipe. Costs less for transportation because it is lighter and easier to handle.

May we send Catalog giving fullest details?

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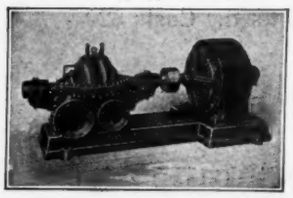
DAYTON-DOWD

CENTRIFUGAL



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SHEAR, FLAP, PLUG DRAIN
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FLEXIBLE JOINTS

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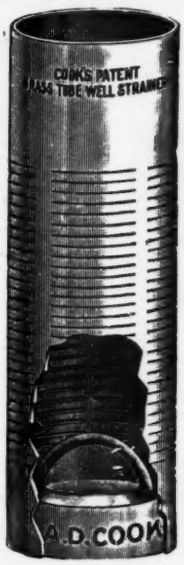

If You Have a DEEP WELL ending in WATER-BEARING SAND OR GRAVEL.

equip it with the COOK PATENT BRASS TUBE WELL STRAINER and secure the maximum capacity of the well free from sand or particles of any kind. These strainers are in use by the Department of Water Supply of New York City, Parkersburg, W. Va., Memphis, Tenn., and Dayton, Ohio.

Upon the completion of the well, allow me to quote upon a Steam Belt or Motor Driven Deep Well Pumping Outlet.

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A REAL CUSHION TRUCK TIRE

Copyright 1922, by The Goodyear Tire & Rubber Co., Inc.

At the left is seen the famous All-Weather Tread and the Indented Sidewall of the new Goodyear Cushion Truck Tire. Right—a cross-section showing the Goodyear Patented Hollow-Center

Goodyear has produced a real cushion truck tire embodying both the original Goodyear Hollow-Center Cushion and the famous All-Weather Tread.

It unites in one tire the resilience of the cushion, the wearing quality of the solid, and the tractive power of the All-Weather Tread.

It is a development of the standard Goodyear Hollow-Center Cushion Tire, more than 30,000 of which have been proved in actual service during the last five years, and it is a distinct advance on that splendid tire.

The Goodyear All-Weather Tread Cushion Tire has a pressed-on base that defies base-separation troubles.

Its tread is the powerfully tractive All-Weather Tread design, insuring sustained headway under all road and weather conditions, saving fuel and engine strain by its sure gripping.

Its triple cushion design makes it a real shock absorber, resilient beyond any other tire excepting the pneumatic. It has the advantage of the patented hollow-center, the high, thick blocks of the All-Weather Tread, and a new sidewall pattern that permits easy compression under pressure.

The Goodyear All-Weather Tread Cushion Tire is made in all standard sizes, up to and including 7 inches, and is specified for all-'round equipment on light and medium duty vehicles and as front wheel equipment with Goodyear All-Weather Tread Solids on the rear, for heavier trucks.

For further information, write the Government Sales Department at Goodyear, Akron, Ohio, or Los Angeles, California.

In placing orders for new apparatus, you should definitely specify this Cushion, unless your needs are for Goodyear All-Weather Tread Solids or Goodyear Cord Truck Tires

GOODYEAR

The Disposal of Municipal Refuse

A modern incinerator is not only an indispensable necessity of all cities and towns, but it is the most sanitary and economical method of disposing of Municipal refuse.

The Nye system of incineration is one of only **three** distinct types of garbage incinerators built in this Country.

The Nye incinerator is the most efficient, most simple, most practical, as well as the most economical in **first cost, in operation** and **in upkeep,** because of its unique scientific design.

During the past eight years the Nye incinerator, like the automobile, has been improved, developed and refined to the highest state of efficiency and perfection.

The Nye incinerator is nationally known. For instance, during the present year Nye incinerators were being built at the same time in the States of New York and Texas, Virginia and Oklahoma, Florida and Minnesota.

There is no excuse for any town or city to be without a Nye incinerator. Our Company takes all the risk, as no payment or advance is required until the incinerator is completed at our cost and expense, and demonstrated in operation by the employees of the city. You get what you buy, and you know it before you pay.

It is a pleasure for us to give specific information and to answer all questions of inquiry.

The Nye Odorless Crematory Co.
MACON, GA.

NYE
ODORLESS
INCINERATORS
LOW COST
UNIT PLAN

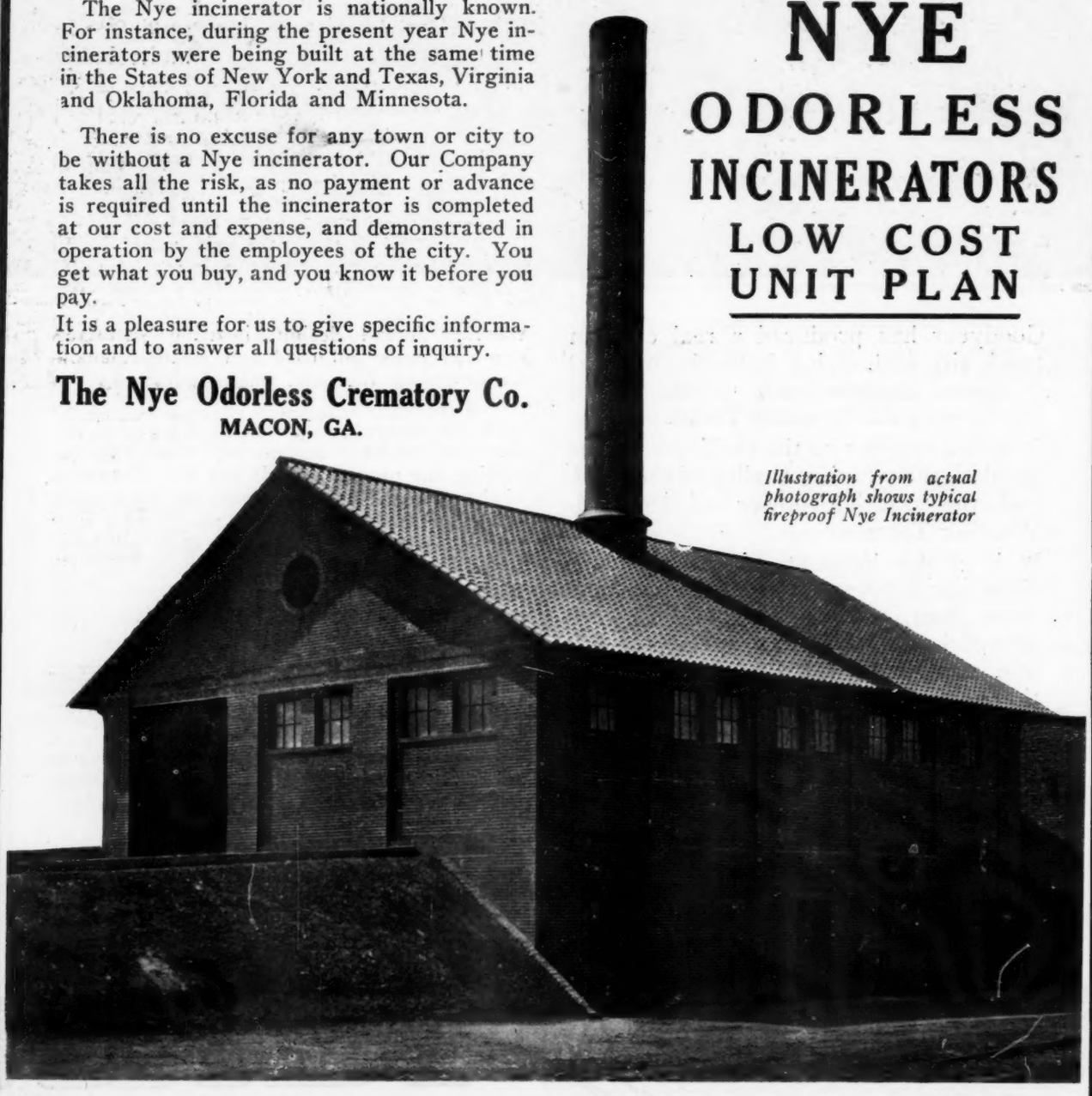
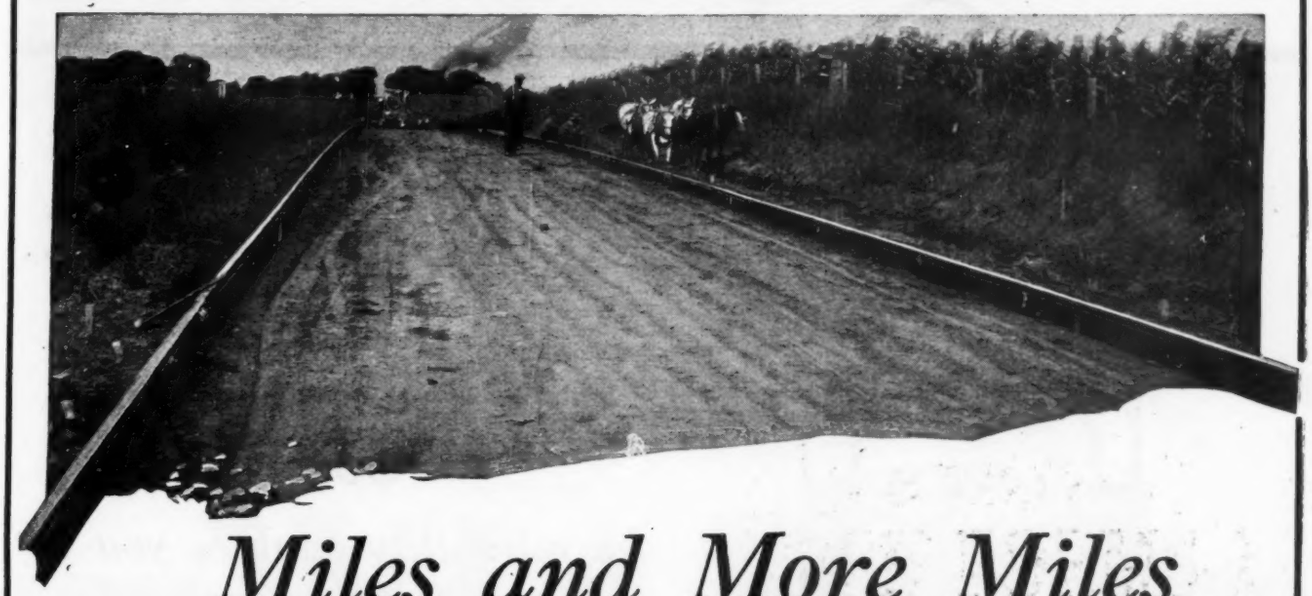


Illustration from actual photograph shows typical fireproof Nye Incinerator



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A Rail
A Pedestal
A Stake
that's all

The Union Paving Company of Philadelphia purchased nearly thirty thousand feet of Heltzel Steel Road Forms.

Their first order called for 3,000 feet; their second order called for 16,000 feet; their third order called for 10,000 feet.

During the first six months of this year over 150,000 feet of this form was sold in Illinois alone. Geo. T. Wilhelm used Heltzel Forms on his 60 mile job in Arkansas.

C. F. Lytle, Contractor, Sioux City, Iowa, used 8,000 feet and ordered 10,000 feet additional 6" Heltzel Forms for his 48 mile job in Florida.

They all pin their faith to Heltzel Forms—WHY? Ask any one of them what they think of Heltzel Forms.

In the meantime, write for literature. You are not obligated by so doing. Why not write now? A one cent postal will bring full information.

The Heltzel Steel Form & Iron Co.

Warren, Ohio

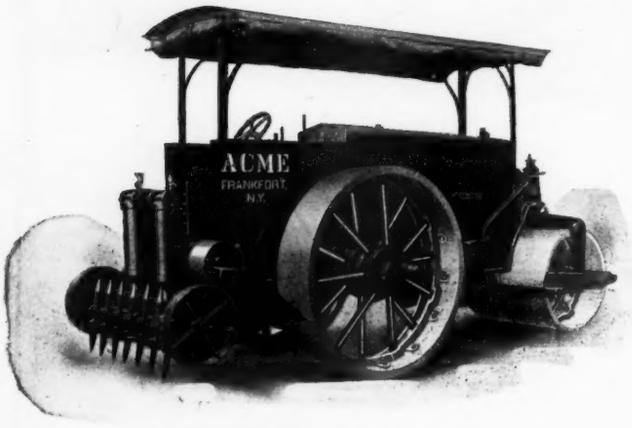
Largest exclusive builders of steel forms for Road, Sidewalk, Curb, Curb and Gutter and all types of concrete construction; Tamping Machines, Heltzel Hand Strikeoff Tamp, Heltzel Rotary Steel Float, and other accessories.

ACME

Equipment

Will Reduce Your Operating Costs

Its reliability enables you to complete your contract on time



4 CYLINDER MOTOR ROLLER

Find out about the full line of Acme Road Building Machinery.

We manufacture: Acme Four-Cylinder Motor Road Roller; Rock Crushers—Solid Cast-Steel Frame Portable and Stationary; Elevators, Screens, Portable Storage Bins; Tom Thumb Graders, Patrol to Traction; Portable Gravel Screening and Unloading Plants; Wagons, etc., Steam Road Rollers.

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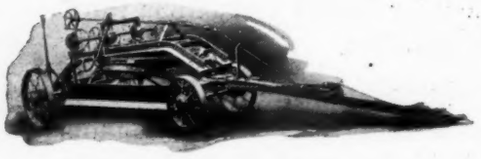
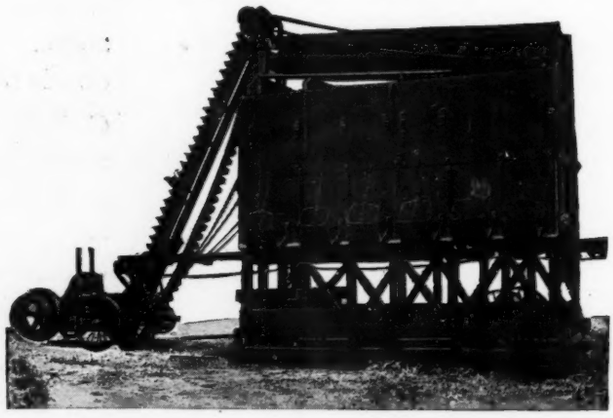


ROAD GRADERS

BOTTOM DUMP WAGON



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ALL STEEL
WIARD STEEL CONTRACTORS PLOW NO.69
WHEN USED AS A ROOTER PLOW REMOVE THIS WING

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ROAD OR CONTRACTOR'S PLOW

For tearing up cobblestones and macadam—it can be used as a perfect rooter and pavement plow by simply removing the steel wing below the moldboard—thus making a TWO-In-One plow for all around work. Ordinarily, the contractor has one plow for general purpose or furrow work and another plow for rooter work or tearing up old pavements. The Wiard does the work of both and answers any and all purposes—means a less investment and keeping in stock extra parts for one plow only.

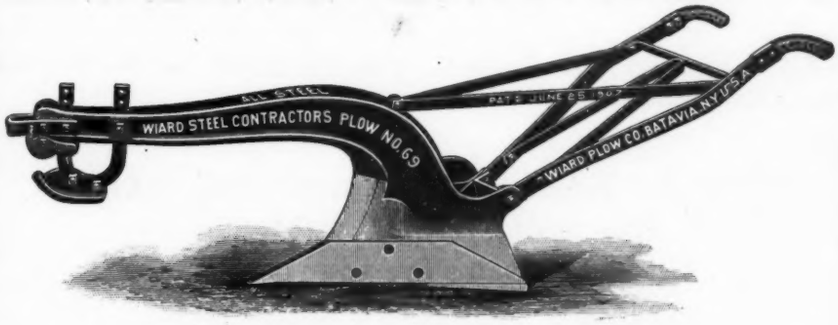
LIGHT AND STRONG

We make a full line of plows for every requirement.

Write for descriptive literature.

Wiard Plow Co., Batavia, N. Y.

USED AS A ROOTER PLOW



No. 69 (All Steel) Contractors' Plow, Landside View

Christmas Greetings to the Oil Industry

In the hustle and bustle of business
With its saving and slaving and grind
We're apt to accredit successes
To the works of our hands and mind.

But this space is taken to tell you
That we feel that the credit is due
For the progress we've made and the good will we've built
To the friendship of such folks as you.

THE HEIL CO.
Milwaukee Wisconsin

CITY OFFICIALS

are beginning to look into their Street Cleaning requirements for 1923 and naturally, when they think of street cleaning equipment they think of the wonderful line of

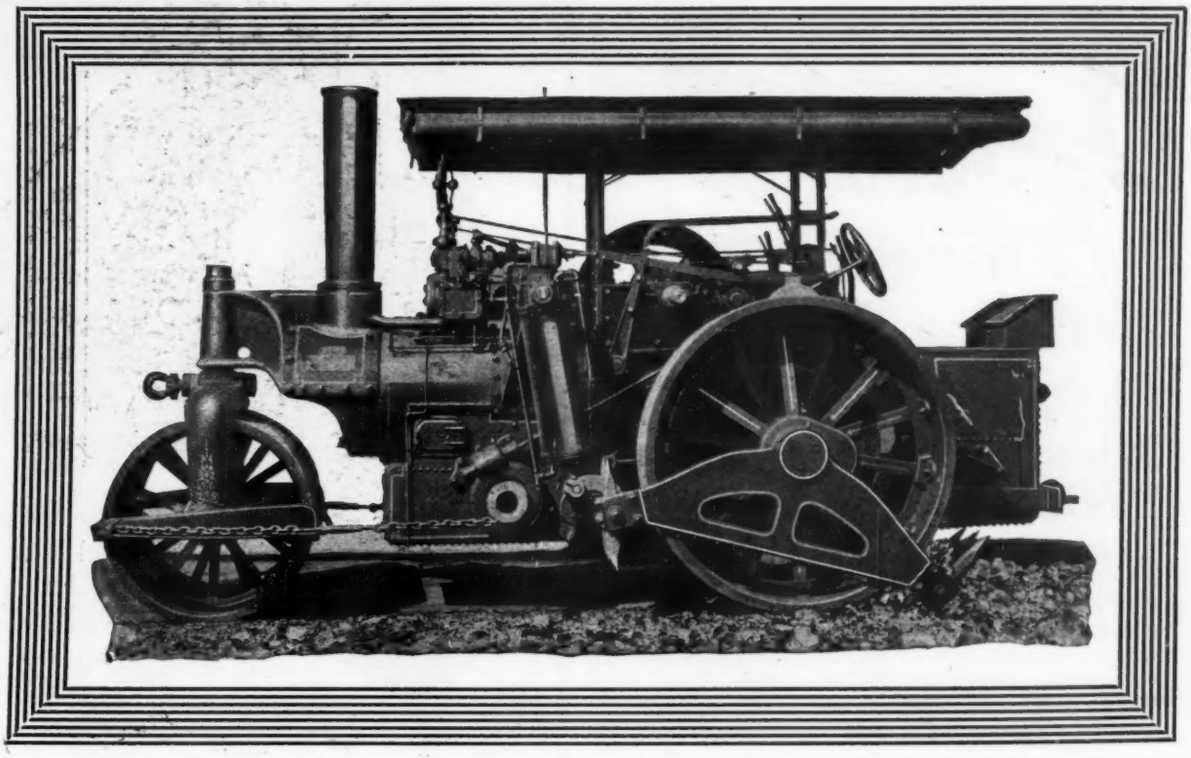
TIFFIN
FLUSHERS AND SPRINKLERS

noted for their superb design, splendid construction, economy of operation and superior working qualities.

Write for detailed information and catalog

Let us help you solve your problems.

The TIFFIN WAGON CO., *Tiffin, Ohio*



No Surface too hard or tough for the

"BUFFALO" MAINTENANCE ROLLER

It is built for heavy rolling and for breaking up cement, asphaltic and Bituminous Concrete surfaces. The location of the loosening device enables heavy scarifying to be done close to the curb.

Scores of "Buffalo" Maintenance Rollers are now in service of counties, municipalities and contractors specializing in difficult work.

They provide increased rolling pressure for present and future demands.

The Buffalo Springfield line includes road and street rollers of all weights and types—both steam and motor driven.

Buffalo Springfield Pressure Scarifiers can be attached in the field to rollers already in service.

INQUIRIES INVITED

The Buffalo-Springfield Roller Co.

Springfield, Ohio

A Guncotton-Nitroglycerin Dynamite Without a Headache

NITROGLYCERIN DYNAMITE has always been the standard high explosive. Until recently it has always had two defects, relatively unimportant in comparison with its basic advantages over other types of dynamite, but nevertheless marked disadvantages. First, it froze at a relatively high temperature, and second, it caused headaches.

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Both disadvantages have now been removed in Dumorite—a guncotton-nitroglycerin dynamite, which is not only absolutely non-freezing but is the first dynamite with nitroglycerin content which will not cause headaches.

Under ordinary conditions, Dumorite does approximately the same work as 40% dynamite stick for stick. And you can buy 135 to 140 sticks of Dumorite at the same price as 100 sticks of "40%."

Dumorite is saving money today for operators in most kinds of blasting work. If it is adapted to your work, your dynamite dollar will be worth $1.35.

Write our nearest branch office outlining your requirements and put the problem of reducing your blasting costs up to our Service Department.

E. I. du Pont de Nemours & Co., Inc.
Explosives Department
Wilmington, Delaware

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DUMORITE

Gar Wood Says:
"That 90% of truck makers advise Wood-Detroit equipment attests its mechanical superiority; that 90% of users specify Wood-Detroit, proves its service."
Gar Wood

Built by "Gar" Wood

The dominance of Wood-Detroit Hydraulic Hoists and Steel Bodies in the dump truck field is so thorough that they not only exceed any other make, but all others combined.

Only an unequalled service record can account for this.

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Hydraulic Hoists and Steel Bodies

If you are interested in dependability in your truck equipment; in speed; in labor saving; and in economy in handling bulk loads; if you demand full efficiency, specify Wood-Detroit.

We will gladly advise you as to the best size and style of Wood-Detroit equipment for your work and chassis.

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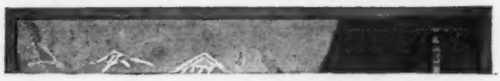
Sales and Service in All Principal Cities



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USED ON BIG JOBS EVERYWHERE

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Doing decidedly more than you expect is the performance of every Russell Machine—a most acceptable service.

They are designed and built to deliver the "extraordinary". They have extra strength built into every part and every piece of Russell Machinery is the product of long experience and studied foresight in road building requirements.

And remember this—when you buy Russell Road Equipment you are fully protected by an absolute guarantee covering service and capacity.

Everything needed for road construction, road maintenance and road repairing—

7 SIZES ROAD MACHINES—
2 SIZES ELEVATING GRADERS—
MAINTENANCE PATROL MACHINES FOR BOTH MOTOR AND HORSE POWER, SCARIFIERS, ROAD DRAGS, DRAG AND WHEEL SCRAPERS, DRAG LINES, GRAVEL SCREENING AND LOADING EQUIPMENT, CULVERTS, STEEL BEAM BRIDGES, Etc.

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Affiliated Plants—Cicero, Ill., North Kansas City, Mo., Memphis, Tenn., Dallas, Tex.

Representatives in all principal cities.

RUSSELL
ROAD EQUIPMENT

Build a Road That Resists Bombardment

When the mighty guns on the Western front hurled broadsides of ponderous steel projectiles, the turrets and forts, regarded as impregnable, crumpled like cardboard. The result was a resort to earth trenches and embankments. Why? Because the only resistance possible was that of absorbing the shock instead of defying it. The same principle dictates shock absorbers and pneumatic tires for automobiles and trucks to protect the vehicle and its load. Our streets and roads must withstand the bombardment of more than four million truck wheels. The shock absorber in this case is the asphalt wearing course whatever the base. Asphalt—resilient, dustless, noiseless, waterproof, wearproof—the pavement of Broadway, Fifth Avenue, Michigan Boulevard, Broad Street, and Pennsylvania Avenue, is the last word in modern pavement design and is no more costly than a rigid, unprotected pavement.

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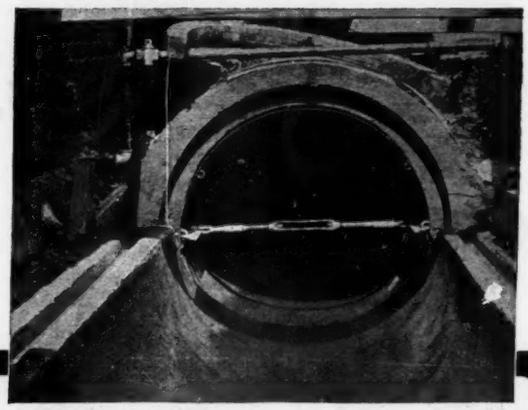

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Any Size-Any Shape

Consider the cost of lumber; the expensive expert labor required to build and knock down the forms and the large pile of almost useless lumber on your hands when the job is finished—and compare the appearances of a wood form and a steel form built sewer.

Blaw Sewer Forms are labor savers, time savers and money savers—they will build real sewers.

Blaw Sewer Forms of standard sizes and shapes are carried in stock—and leased to you. Sewers of especially large size or odd design require special forms, which we will design and build to suit your needs.

Submit your proposition to us for an estimate—write us.

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PITTSBURGH, PA. 611 Farmers Bank Bldg.
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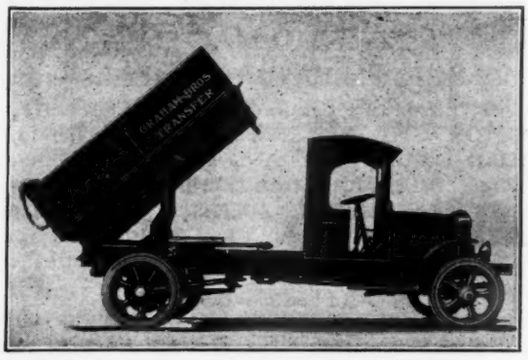

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Greater Dumping Angle Than Any Other

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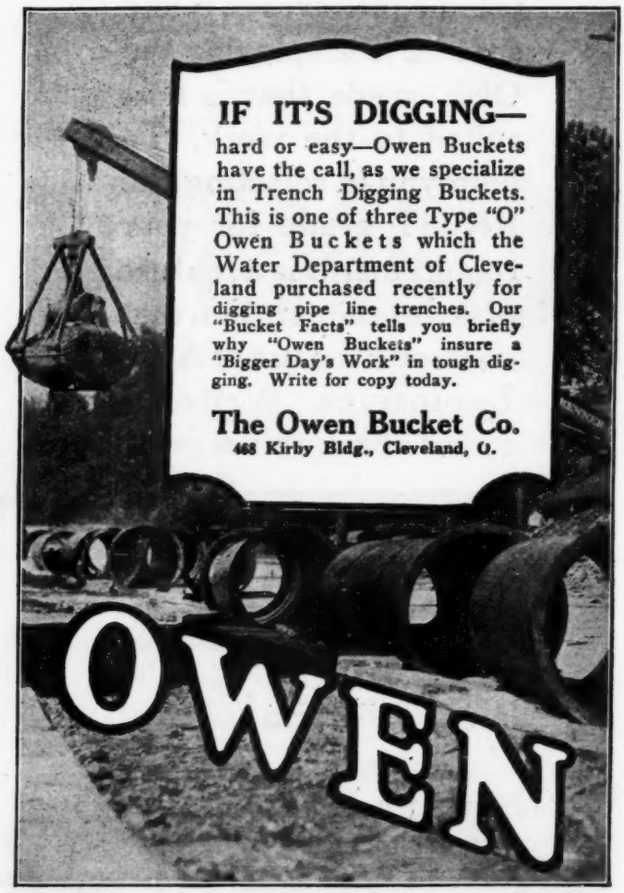
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THE well-known strength of corrugated metal insures the purchaser of Newport Culverts that he is getting the maximum strength for supporting the overburden and traffic load. Made in full-round and half-round shapes to fit every condition. The moderate first cost is the only cost. They last a life-time. Full descriptive literature sent free on request.

100% QUALITY

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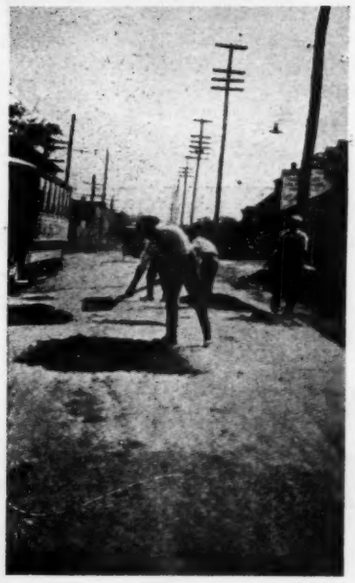
for STRENGTH

COLD PATCH



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Repairing Bituminous Concrete

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Same, two months later, showing repairs after being consolidated by travel

HEADLEY No. 1
AN ASPHALTUM EMULSION

For repairs and resurfacing.

No expensive heating plant required.

Can be used in wet or dry weather.

No time lost account wet materials.

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Illustration shows N. P. B. M. Standard Rattler for testing of paving brick.

COMBINES ALL THE LATEST IMPROVEMENTS
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Thoroughly tested and tried out for a period of one year under the direction of the technical committee of the National Paving Brick Manufacturers' Association.

Write for descriptive circular and prices.

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LOAD A FIVE-TON TRUCK
FOR TWENTY-FIVE CENTS

By Using a
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CAPACITY 25 TO 35 TONS AN HOUR

BEARS THE USUAL GENEROUS RELIANCE GUARANTEE
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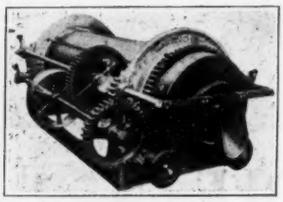

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Rakes and scoops the material against a constant flow of water, which frees it from dirt, clay and other impurities. Easily moved from one job to another—it is portable. All parts are interchangeable. Washes ten or more tons per hour. Write for further information.

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Steel Stacks
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Riveted Tanks

THE JOS. HONHORST CO.
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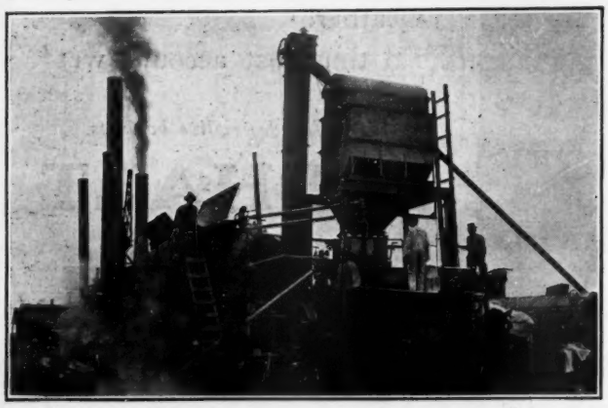

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ALL TYPES

The J. D. Farasey Mfg. Co.
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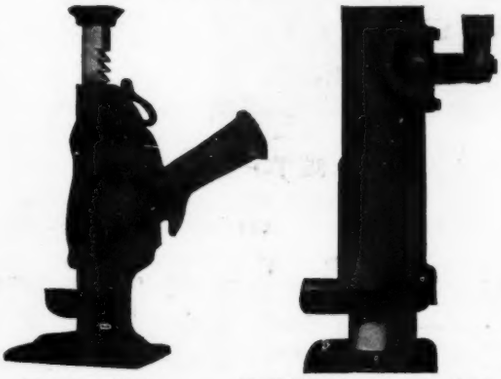
Duff Trench Braces

Why there are over 1,000,000 in use

DUFF JACKS
Two Popular Duff Jacks



Ratchet Jack Ball-Bearing Screw Jack

Duff Combination Screw and Timber Braces in foundation work, Bush Terminal Building, Strand, London, England.

YOU know the cost of cave-ins. You know the danger to human lives. You know the cost and high loss of lumber struts and braces.

Duff extensible trench braces eliminate danger of cave-ins and accidents. They brace the trench securely. As they are quickly set and removed, they save labor.

Owing to the ball and socket joint, Duff braces securely grip the sheeting on each side of the trench, and cannot be accidentally dislodged. Neither vibration of machinery, nor careless acts of laborers can knock them down. That's a few of the reasons why contractors everywhere are making Duff trench braces as part of their regular and permanent excavating equipment.

Send for Catalog of Duff Trench Braces and Lifting Jacks for all purposes.

The Duff Manufacturing Company

Established 1883 **PITTSBURGH, PA.**

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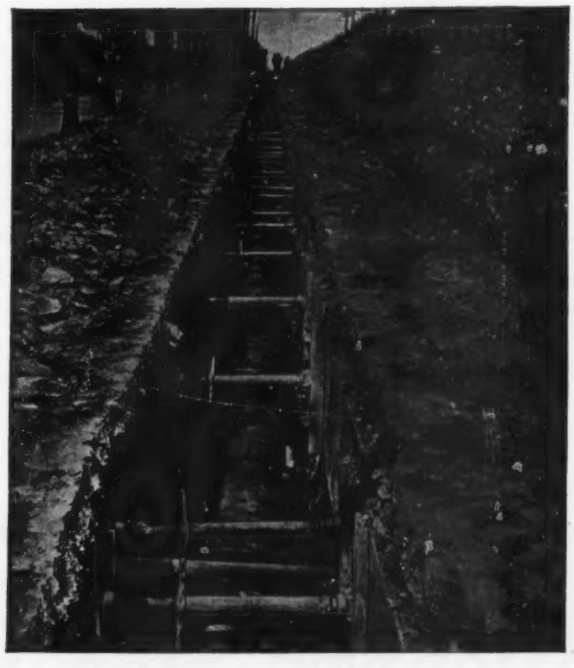
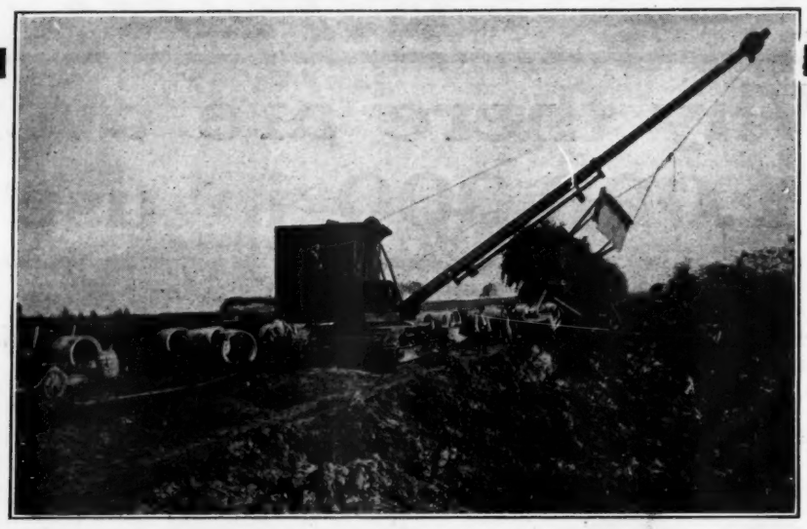


A characteristic example of efficient, economical, and safe bracing in street excavation work. An effective arrangement of **Duff All-Iron Extensible Trench Braces** affording plenty of working space.

DURABILITY



Concrete Pipe supplied to the City of Kenosha, Wisconsin. Note pipe placed along line of trench and ease in excavating and backfilling.

STRENGTH—SPEED SATISFACTION

The unusual strength and ability to withstand exceptional loads has been a source of much satisfaction to many of the leading City Engineers.

The contractor knows that he can install Independent Concrete Pipe at a distinct saving in equipment, time and money. He knows that with the minimum of effort he can put in a perfect job at a good profit—a job that will satisfy the engineer in every respect.

Upon request we will be glad to submit data covering Independent Concrete Pipe from the viewpoints of the Municipality, the Contractor, and all others interested.

Ask for special booklet

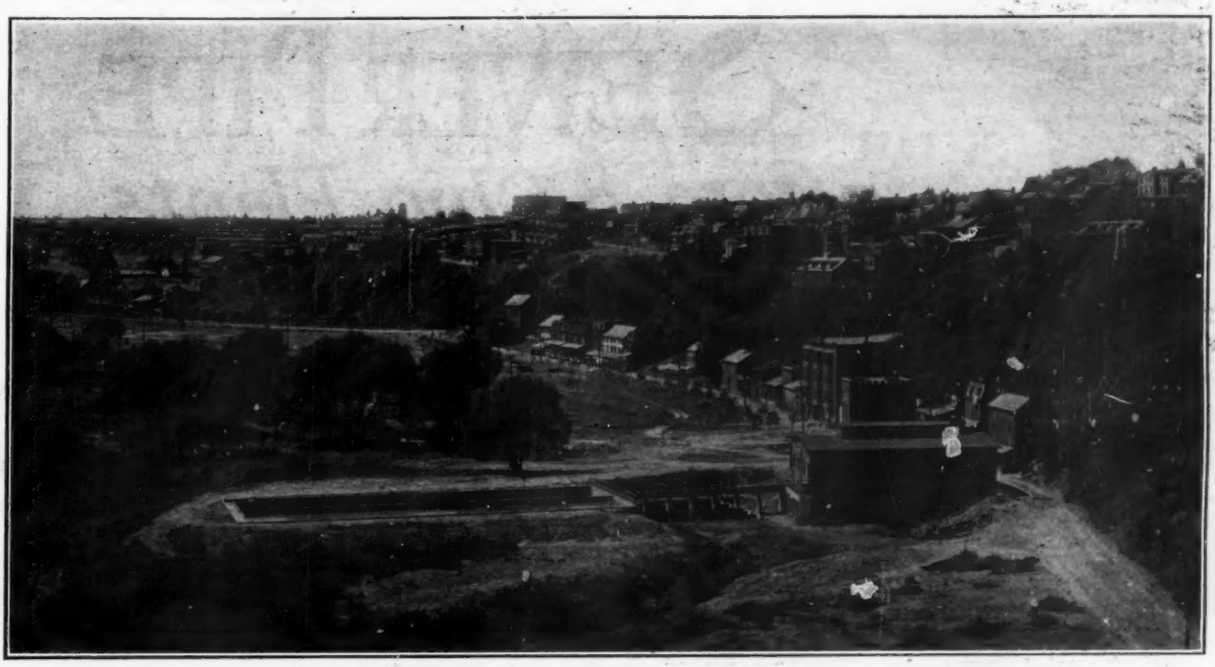
Independent Concrete Pipe Company

Indianapolis, Ind.

CONCRETE PIPE FOR PERMANENCE

Why should there be a Sewage Disposal "Problem"?

Direct Oxidation plants dispose of sewage without nuisance 365 days a year. Their installation and operation are no more a "Problem" than the building and operation of a lighting plant or a water pumping station.



Municipal Direct Oxidation Plant at Allentown, Pa. (Pop. 85,000)

Direct Oxidation plants may be located at the most economical point, without regard to isolation, as they produce neither odors nor flies.

DIRECT OXIDATION DISPOSAL CORPORATION

LAND TITLE BUILDING

PHILADELPHIA

VITRIFIED SEWER PIPE

from 8 Ohio Plants

Prompt Shipments

The Ohio Vitrified Pipe Co. Uhrichsville, Ohio

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ACCOMMODATIONS BETTER THAN RATES INDICATE

BROADWAY CENTRAL HOTEL

Midway Between Battery and Central Park, Broadway at 3rd Street, New York City; Heart of Wholesale District; Capacity, 1,000 Guests.

Rates:
250 Cheerful Rooms, Free Use of Tub or Shower Bath $1.00
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150 Cheerful Rooms, Private Bath.....$2.00 up
Two and Three Room Suites in Proportion

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South Bend Foundry Co.

SOUTH BEND, INDIANA

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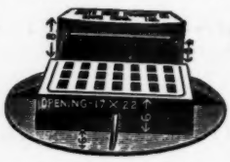

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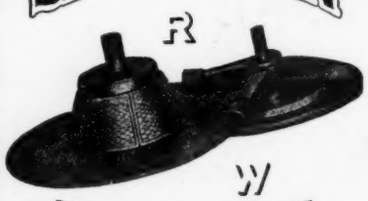

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FOR MUNICIPAL WATERWORKS, SEWAGE SYSTEMS, IRRIGATION PROJECTS and DRYDOCKS

Sanitation-Geiger Gates, Valves and Control Apparatus, D'Olier Automatic Pumping Machinery and Ejectors, Sanitation-Geiger Water Screens, Larner-Johnson Valves

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Engineers and Manufacturers
165 BROADWAY NEW YORK CITY

We ship Promptly

Try us on any quantity of

VITRIFIED SEWER PIPE

12 Plants
110 Cars Per Day

"Watch Our Speed"

The Robinson Clay Product Co.

Akron, Ohio

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FOR

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BY THE

"SIMPLEX" AUTOMATIC SLUDGE PRESSING EQUIPMENT

NO HEATING OF SLUDGE REQUIRED

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No Breaks—No Lagging

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Facilitates the laying of sewers. Make water-proof joints. Free from every defect known to pipe laying. Permits partial back-filling of the trench before the joints are made, thus promoting proper alignment of the pipe and preventing the breakage of the joints during back-fill. Can be laid in trenches containing water and water running through the pipes.

Write for circular giving the full story.

L. A. WESTON, Adams, Mass.

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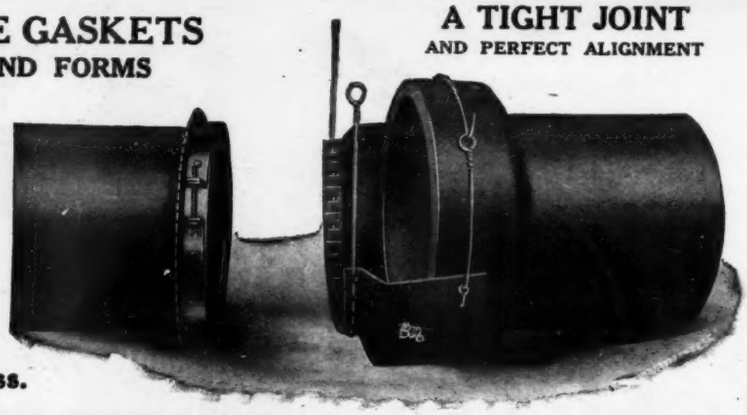
AND PERFECT ALIGNMENT



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Manufacturers of COMPRESSED AIR FIRE WHISTLES, WHISTLE BLOWERS, BELL STRIKERS, BOXES, GONGS, Etc., Etc.
Estimates Cheerfully Given

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"Used in Nearly Every State in the Union"
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We pay freight and ship for trial. Who else will do it?
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Portable Plants (3 Units) four sizes; 750, 1250, 1800 and 2000 sq. yds. 2 inches top daily.

One-car steam melting 2000 square yards. 2 inches top daily.

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The McCanse System for Municipalities

ODORLESS AND SMOKELESS

The Most Economical

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SEWER AND HIGHWAY CASTINGS

The largest manufacturer of sewer and highway castings in the United States.

Send us your inquiries for manhole heads, inlet basins, etc., singly or by hundreds.

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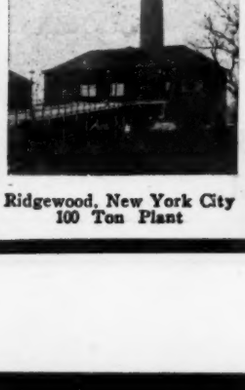

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100 Ton Plant

for Municipalities and Institutions

We are one of the oldest concerns in the United States engaged in the erection of incinerators for the final disposal of municipal refuse.

Our plants are of a distinctive type, and of scientific design passed upon years of experience. We have over 50 municipal installations in the United States and Canada. Among these are 15 repeat orders. Write us the conditions in your city and our engineers will furnish you with preliminary plans and proposals for the proper size of plant for your requirements.

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SEWER PIPE
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No caulking is necessary with JOINTITE. Alternate joints may be poured on the bank. Easily handled and placed. No skilled help required. Sets as soon as poured. Adheres to the pipe.

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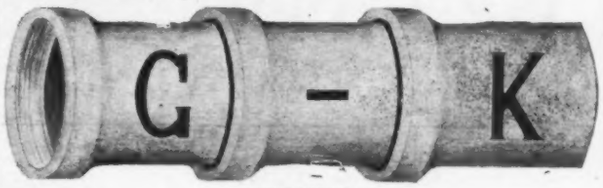

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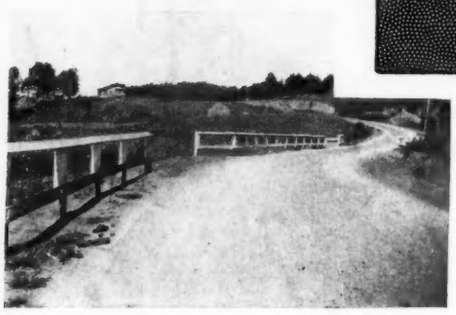

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